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MAY 17 1937

AUTOMOTIVE INDUSTRIES

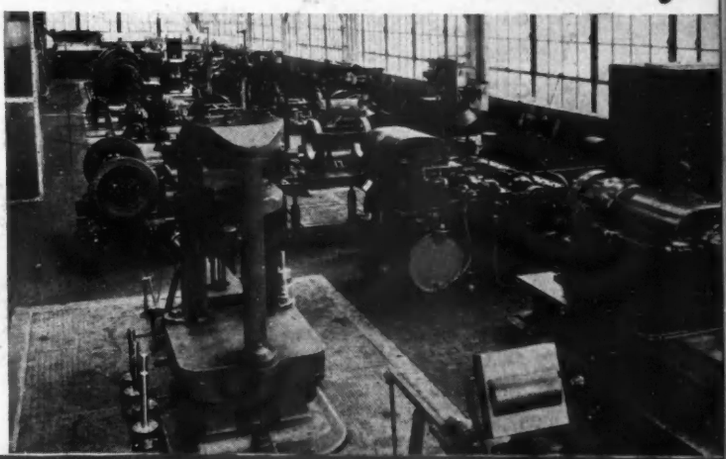
LAND — AIR — WATER

MAY 15, 1937

The EXTRA things *the Timken Company does to give extra value and extra service to users of* TIMKEN *Bearings*

★

When the automobile manufacturer buys TIMKEN Bearings he gets more—a great deal more—than a box of bearings and an invoice. He gets the tremendous benefits of the many extra things The Timken Roller Bearing Company does to put extra quality, extra accuracy and extra life into TIMKEN Bearings—and so does the automobile buyer.



A section of the main testing room of the new Timken Physical Laboratory

THE NEW TIMKEN PHYSICAL LABORATORY

Scientific research and testing have always been important factors in TIMKEN Bearing production and application. Never before in the history of the bearing industry, however, have there been any research and testing facilities to match those of the new Timken Physical Laboratory.

Housed in a specially constructed building entirely apart from the main factory is the greatest array of research and testing apparatus ever assembled for its specific purposes. A tremendous investment in apparatus—including many specially designed machines and instruments to be found nowhere else.

In this new laboratory with its ultra modern equipment and revolutionary methods, any operating condition can be duplicated and every conceivable test carried through to a definite conclusion. Here exact knowledge is the rule in every problem of anti-friction bearing application and operation. Furthermore, the scope of the work is not strictly confined to the bearings themselves, but extends to the testing of many parts and materials upon which the full success and satisfaction of any particular bearing application may ultimately depend.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

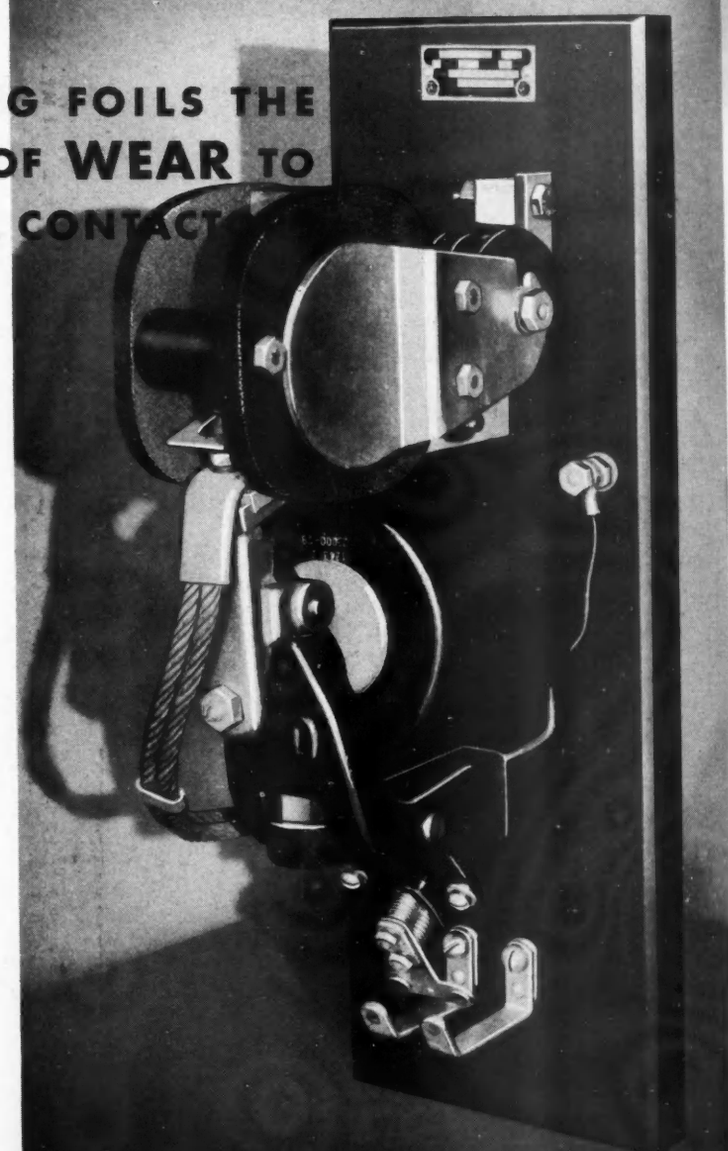
TIMKEN
TAPERED ROLLER BEARINGS

THE CHISELER *Chiseled!*

CLARK ENGINEERING FOILS THE PERSISTENT EFFORTS OF WEAR TO SHORTEN THE LIFE OF CONTACT

WEAR, little demon that he is, finds himself thwarted in every attempt he makes to destroy the Clark Contactor. He discovers to his chagrin that:

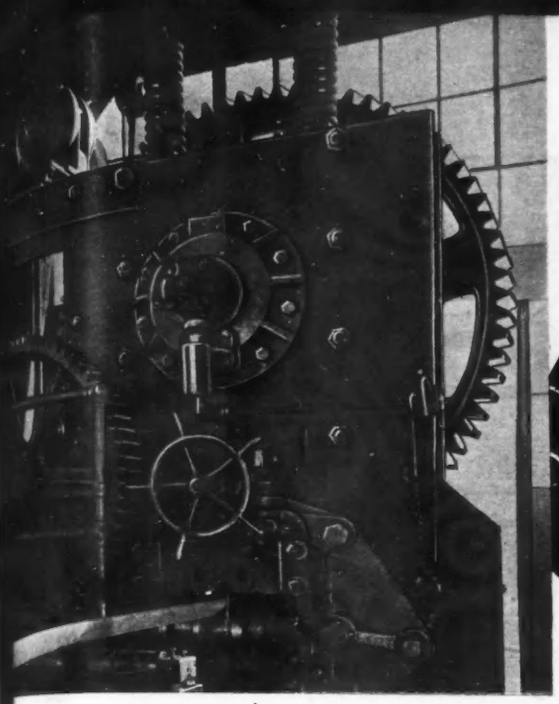
1. The arc shield is made of Carborax, practically impervious to arcing and heat.
2. The blow-out coil has more turns and a larger cross section. Result: greater magnetic effect and increased carrying capacity.
3. The blow-out coil is fastened securely to the terminal studs by Everdur bolts, which have approximately the same coefficient of expansion as copper.
4. The movable contact arm and main arm turn on renewable Nitralloy pins surrounded by renewable Nitralloy bushings—"Nitralloy to Nitralloy"--minimizing wear. Easily adjusted to maintain correct contact pressure.

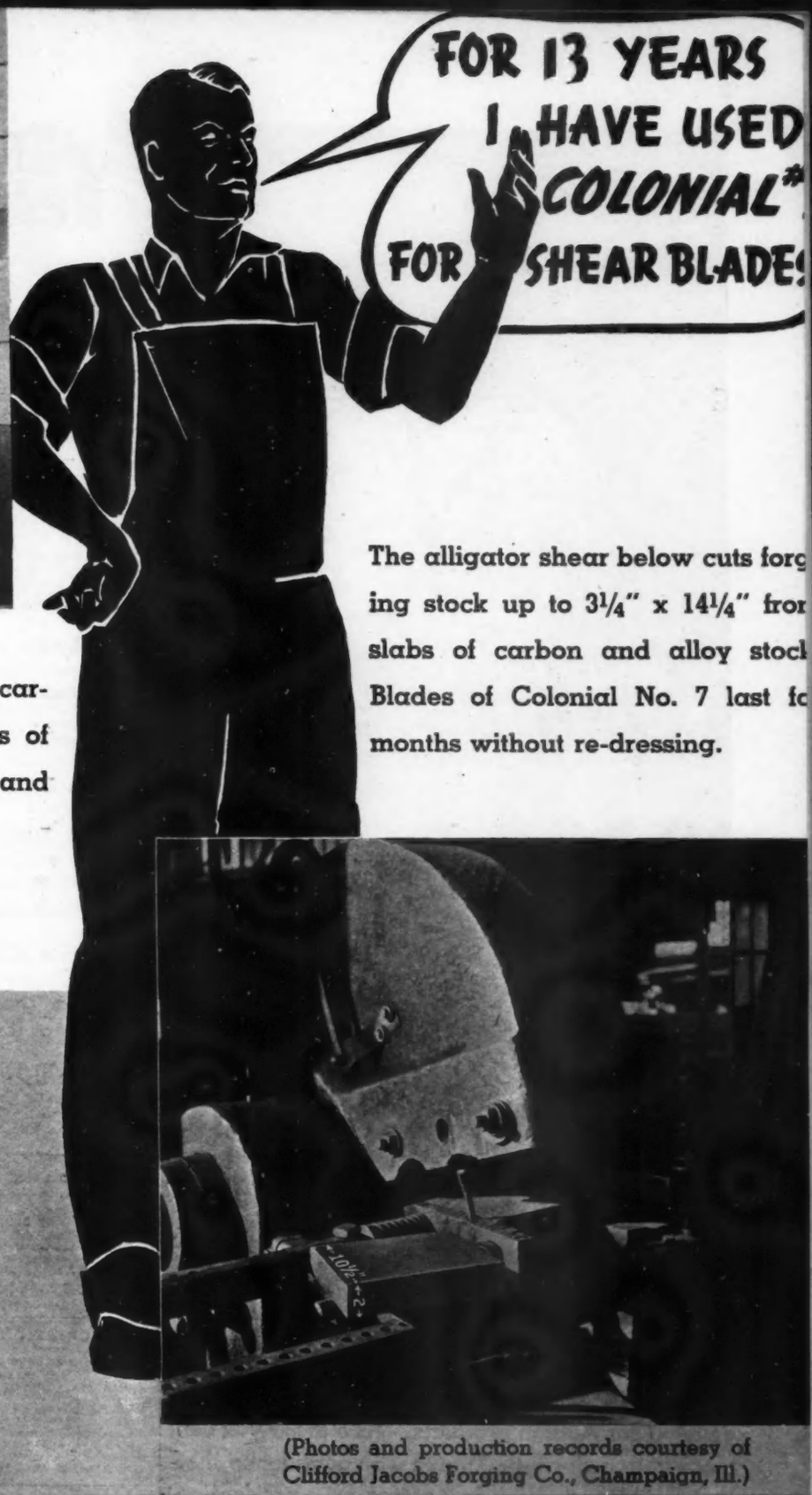


The Clark 300-ampere, single-pole contactor. Observe how in this trim, business-like Clark unit cotter pins have been eliminated in both Movable Contact Arm and Main Arm. At all pivotal points—wherever there is relative motion—renewable Nitralloy pins and renewable Nitralloy bushings have been installed. The same features are found in the 100-, 150-, and 600-ampere contactors.

THE CLARK CONTROLLER COMPANY

1146 EAST 152nd STREET CLEVELAND, OHIO





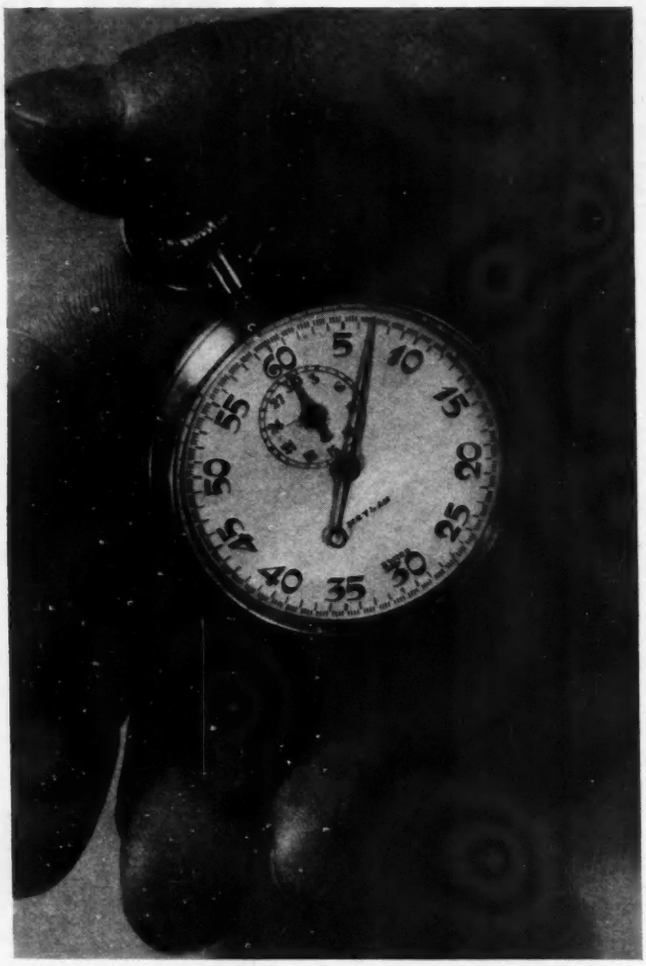
Shearing bar and billet stock, both carbon and alloy steels. Shear blades of Colonial No. 7 are used six months and more before re-dressing.

The alligator shear below cuts forging stock up to 3¼" x 14¼" from slabs of carbon and alloy stock. Blades of Colonial No. 7 last for months without re-dressing.

(Photos and production records courtesy of Clifford Jacobs Forging Co., Champaign, Ill.)

VANADIUM-ALLOYS STEEL COMPANY

LATROBE, PA.



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AUTOMOTIVE INDUSTRIES

Founded 1895

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May 15, 1937

This Week

NEWS emanating from Detroit is dominated by reports of feverish efforts on part of automobile producers to meet demands of huge banks of unfilled orders . . . Registrations peaked to a history-making, all-time high for first three months . . . UAW men were scorched by union member employes for easing off original demands in Packard negotiations. Company officials seem well satisfied with agreement finally effected . . . Out of Washington, D. C., came prediction by Representative Keller that no NRA code for the automobile industry will be born in this Congress.

FEATURE material in this issue is highlighted by a comprehensive article on Plastics, with emphasis on automotive application. This is the third article in the Automotive Industries series on materials . . . More abstracts of technical papers presented at the SAE Summer Meeting will be found on page 737.

Unfilled Orders Swamp Factories

Capacity Output Making Little Dent in Retail Bookings; Some Dealer Organizations Average Only Week's Supply

With practically the entire automobile industry operating at top speed, little progress is being made in cutting down the accumulation of unfilled orders at the factories. Some of the leading producers are booked ahead as much as two months and in certain instances the unfilled order bank is still growing in the face of capacity output. No abatement in retail demand is in evidence.

The industry appears to be slated for the current high production rate through the second quarter and there is likely to be very little slackening of pace until late in the summer. At no time in recent years have dealers' stocks been so low at the height of the selling season. In many cases, stocks are at an irreducible minimum and business is being conducted on a hand to mouth basis. Including display cars and demonstrators, some of the leading dealer organizations average only a week to ten days' supply on hand. One dealer organization of nearly 3000 members has an average of only 1½ cars per dealer on hand.

Upwards of 560,000 vehicles should be turned out in May, unless labor troubles interfere. Although the union has agreements with all companies except Ford, it has not been very successful in maintaining discipline of its members and unauthorized strikes continue to crop up with resultant loss of output at various plants. If the factories are permitted to carry out their schedules this month, May should establish a new high for production since 1929.

April finished with a considerably higher output than had been anticipated. Although Chrysler, Hudson and Reo plants did not reopen after their strikes until nearly the middle of the month, they lost little time in resuming full scale operations. On the basis of the AMA report showing production of members at 387,163 units, it is estimated the industry's total for April reached 550,000 cars and trucks, which compares with 518,715 units in March and 527,726 in April last year which was the peak month for 1936. May output will suffer by having one less working day than April, but with all plants in operation, it stands a good chance of topping the April figure.

Push Tire Production

Goodrich Oaks Plant at Capacity; Other New Factories to Start-Up

The new Oaks, Pa., tire plant of the B. F. Goodrich Co., Akron, is now operating at capacity with a daily production of between 4000 and 5000 tires, with its production confined to original equipment tires for Ford and Chevrolet, according to Samuel B. Robertson, new president of the Goodrich Co. Mr. Robertson, former Pennsylvania railroad official who joined Goodrich in 1919, succeeds James D. Tew who resigned the presidency May 5.

The Oaks plant formerly was a rubber reclaiming plant but has been completely remodeled and equipped with the latest type machinery. The Goodrich subsidiary plant at Cadillac, Mich., will not produce tires, according to Mr. Robertson, but will confine its production to extruded rubber goods, window moldings, etc., for automobiles.

Production in the new Goodyear tire plant at Jackson, Mich., will get under way by July 1, it is understood. This plant, the former Hayes wheel factory, is being equipped with modern tire building machinery and will have a capacity exceeding 20,000 tires per day. It will become the key Goodyear plant on original equipment tire production for car manufacturers. Goodyear already has assigned many of its department heads to management and executive posts at Jackson.

Firestone's new tire plant at Memphis, Tenn., is reported to be in production. Plans call for this factory to produce upwards of 5000 tires per day when fully equipped.

AFL Cries 'Profiteering'

Claims Price Boosts Not Justified By Wage and Cost Increases

Accusing several large industries as guilty of raising prices to amounts not justified by higher wage levels and other increased costs of production, the American Federation of Labor on May 10 suggested appointment of a Federal commission to control prices. The attack claiming price profiteering was

(Turn to page 715, please)

Workers Ratify UAW-Packard Pact

Union Blasted By Adherents for Easing Demands; Company Official Terms Agreement "Workable"

After some protest and outbursts of dissatisfaction, Packard employes at a mass meeting on May 9 in the State Fair coliseum voted to accept the agreement with the management negotiated by representatives of the United Automobile Workers of America to whom they had delegated sole bargaining rights in an election under the Wagner Act.

Only about 1000 of the 14,243 employes who voted in the Labor Board election were present at the ratification meeting and finally accepted the pact by a 10 to 1 vote. Richard T. Frankensteen, organizational director for the union, was interrupted by boos as he read the provisions of the agreement to the assembly.

Protests came from the floor when he announced that a blanket wage increase of 3 cents an hour had been agreed upon instead of the 10 cents an hour originally demanded, that minimum wages were to be 65 cents for women and 75 cents for men instead of 75 and 85 cents, respectively, and that the company's policy of giving one week's vacation with pay would be continued in place of the two weeks which had been asked.

The agreement, signed Friday, May 7, is to remain in effect until May 1, 1938. It recognizes the UAW as the exclusive representative of hourly rate workers, establishes a shop-steward system and provides machinery for handling grievances. In case of a general lay-off, it provided that hours of work be reduced to 32 hours per week before anyone is laid off. Speed of operations is to be discussed with the chief steward of the department or referred to the plant committee whenever necessary. Time and a half will be paid for more than 8 hours a day and 40 hours a week, and double time for Sundays and holidays. Workers on night shifts will get an additional 5 cents per hour. Seniority rules are established. The company is protected against strikes during the life of the agreement. Intimidation or coercion on the part of either party is prohibited.

M. M. Gilman, Packard vice-president and general manager, called it a "workable agreement with does not place the company at a disadvantage with its competitors."

Morris Field, UAW organizer and one of the negotiators in the Packard conferences, told the Sunday night audience that "this agreement paves the way for us to go in next year and ask for a closed shop. We can then refuse to work with any man in any plant who does not belong to the union." He predicted that the union would have sole bargaining in GM plants within a year.

Frankensteen urged Packard workers to aid in the organization of Ford employes, saying "we have taken in 7500 members within the last couple of weeks and we're just getting started."

Unauthorized strikes again interrupted operations in General Motors plants last week. In St. Louis, 4000 employes were affected when Chevrolet and Fisher Body workers struck in protest against the laying off of 37 men. The plants reopened on Monday after being closed since Wednesday last week. Negotiations in which national officers of the union participated resulted in an agreement which union officials claimed would establish a precedent and do away with the sporadic strikes suffered by GM plants. According to the secretary of the St. Louis local, it gave seniority rights to temporary workers, predicting this would become national policy in relations with GM.

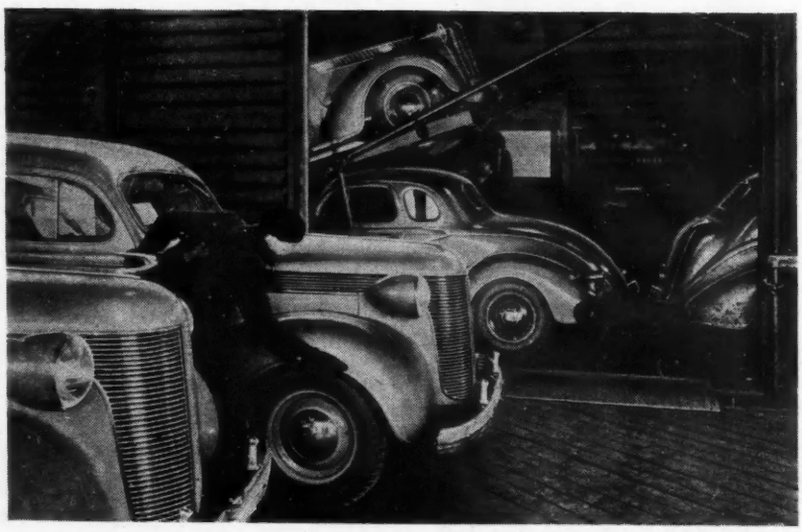
A dispute between a UAW man and a member of the Independent Employes Association resulted in a three-hour sit-down strike in Chevrolet plant No. 10 at Flint, Friday night last week. The plant which does not operate on Saturday resumed work Monday morning.

The Ternstedt division of GM has recognized the American Labor League as spokesman for its members, according the new organization the same recognition given the UAW. Ternstedt was not one of the 17 plants involved in the general strike. It is understood that the Chevrolet Gear & Axle plant is also extending some sort of recognition to the League.

The general executive board of the UAW, which has been in session in Detroit for several weeks, adjourned last Friday. Among its accomplishments was the determination of a plan for governing large locals such as Flint, Toledo and the Detroit West Side. A delegate body known as a joint council is to be set up in each large local and is to be made up of regular executive officers and trustees, the shop chairman and recording secretary of each shop unit in the local and delegates elected from the shops. In locals having fewer than 15,000 members, one delegate will be allowed for each group of 50 members in the shop. For locals of more than 15,000, one delegate will be allowed for each group of 100 shop members. Actions of the joint council can be rescinded by a majority vote of members.

The board voted to nullify a recent primary election of the Flint local on grounds that it was held before the board had decided on the structure of such locals.

The Dodge Local No. 3, comprising approximately 20,000 members, is voting this week on three candidates for the presidency and a list of other nominations. Balloting is by mail. Richard T. Frankensteen, organization director of the UAW, is one of the nominees for the presidency.



LOADING of passenger cars is speeded at the De Soto factory by the Evans Autoloader pictured here. Metal loading rails and chains replace the old-type block-up system formerly used. Four new De Sotos are carried in every freight car leaving the plant.

Exports From Canadian Jump

Exports of motor vehicles and parts from Canada in March were valued at $3,056,592 compared with $1,944,872 in February and $3,391,021 in March, 1936. Of these totals, automotive parts accounted for $398,432 in March, 1937, $256,758 in February, 1937, and $446,071 in March, 1936, according to the Automotive-Aeronautics Trade Division, Department of Commerce.

Overseas sales of passenger cars from Canada in March showed a decided increase over February and totalled 5,040 units, valued at $1,905,186 compared with 2,339 units, valued at $947,385. March, 1936, exports totalled 5,996 units, valued at $2,338,823, it was stated.

CORONATION of the British king and queen in London on May 12 found motor vehicles very much in the limelight. The photograph above shows part of a special fleet of 150 Daimlers, complete with chauffeur, provided for the transportation of distinguished visitors to the ceremonies. American manufacturers benefited from the coronation also. For example, when the "Queen Mary" sailed May 5 she carried in her hold the last of a sizable number of Buicks specially ordered for delivery coronation week. The coronation rush kept the Buick factory export department "extraordinarily busy during the last two months," according to James R. Seitz, manager.

Strikeless Era

CIO Organizer Haywood Predicts Peace in Rubber Industry for Balance of '37

A strikeless period for the balance of 1937 for the rubber and tire industry was forecast by Allan S. Haywood, CIO organizer, on the eve of his departure from Akron May 10 to take up special duties in New York under special assignment of John L. Lewis. Haywood directed negotiations of the United Rubber Workers Union with Firestone during the recent eight weeks' Firestone strike, and has since negotiated with Goodyear, Goodrich, United States Rubber and other tire companies on contracts similar to that consummated with Firestone. The Firestone pact provides for collective bargaining with the CIO for such employes as desire CIO representation.

Haywood would not disclose details of proposed contracts with other rubber and tire companies. At a farewell banquet in his honor given by Union Rubber Workers in Akron, Haywood predicted industrial peace for the remainder of 1937 in the rubber and tire industry and said:

"The rubber workers are two years ahead of the automobile workers, and the rubber workers are looked upon as the most responsible of the new labor groups."

Firestone plants, closed from March 3 to April 30 by the CIO strike, are gradually gaining momentum with many thousands already re-hired and work proceeding at full speed in many departments.

Members of the General Tire & Rubber Co. URW union have voted to rescind former action approving a flexible 36-hour week.

SAE Summer Session

Lively Debate on Fuels and Lubricants Highlight at White Sulphur Springs

More than any other subject, fuels and lubricants provided ground for discussion at the summer meeting of the Society of Automotive Engineers, which closed Sunday morning, May 9, at White Sulphur Springs, W. Va.

A lively discussion followed the presentation by W. A. Witham, Gleason Works, of his paper titled, "Hypoid Gears, Axles and Lubricants."

Among the principal discussors was W. H. Graves, chief metallurgist, Packard Motor Car Co., who made the important point that in his organization the SAE test for E-P lubricants correlates not only with the service testing but with the results obtained on the four-square laboratory machine. Going into specific details, Mr. Graves indicated that the SAE machine when operated at 550 r.p.m. has little merit. It gives better correlation at 750 r.p.m., but when operated at 1000 r.p.m., it gives excellent results and may be used for the selection of new materials as well as for writing specifications.

Speaking for General Motors Research, H. C. Mougey reported that at the present time they have no standardized specifications on E-P lubes although the laboratory has tested over 200 materials. Now the big problem consists in the correlation of laboratory tests with performance in the car, and it is probable that laboratory tests may be sufficient criteria for selection. It is Mr. Mougey's conclusion that no single test of E-P quality is sufficient but that a combination of laboratory tests will give good results.

In summarizing the discussion, Mr. Witham pointed out that hypoid ring gears cannot be reduced beyond present practice due to limitations of the lubricant. If and when a perfect lubricant becomes available, it should be possible to make a further reduction in size. Hypoid gearing has been developed experimentally for truck jobs, using a maximum offset of about 1¼ in. The gearing seems well suited for jobs requiring extreme reduction of gear ratio and on such applications, they have been able to use a ring gear of 11 in. diameter.

When C. M. Larson presented his paper entitled, "Need for Simplifying Recommendations of Transmission and Rear Axle Lubricants," he opened a debate characteristic of the fuels and lubricants activity in automotive circles.

Dr. A. M. Wolf of GMR started the ball rolling by his statement that a lot of work must be done in the matter of

(Turn to page 718, please)

NRA Bugaboo Waning

No Likelihood of Code for Automobile Industry At This Session of Congress, Says Keller

There is no likelihood that the automobile industry will be set apart and codified at the present session of Congress. This reassuring message was given to AUTOMOTIVE INDUSTRIES by Representative Keller, Democrat, of Illinois, chairman of House labor subcommittee in charge of the little NRA textile bill, who has predicted that the measure will be a model for the automotive, steel and mining industries.

It is the idea of Mr. Keller that separate codes be set up for these basic industries with general regimentation legislation on wages, hours, working conditions and trade practices for other industries of the country. But he said it is not contemplated to set up individual codes for these industries at the present session, the plan being to confine such codes to bituminous coal, already effective, and to the textile industry.

Actually, any further industrial control legislation will depend upon the White House, and until the President announces a program it is a matter of uncertainty what form the legislation will take. The administration has definitely indicated that it will ask for such legislation at the present session of Congress. It is believed that the President will soon confer with Congressional leaders for the purpose of outlining a program. The opinion prevails that aside from coal and textiles, the proposed legislation will be covered in an omnibus bill rather than by separate measures for individual industries, despite the plans of Mr. Keller. The assumption is that the administration can, if it insists, jam through NRA legislation, although it will undoubtedly meet with strong opposition by minority groups.

First Three-Months' Sales All-Time High

New Passenger Car Registrations

	March 1937	February 1937	March 1936	Three Months 1937	Three Months 1936	Per Cent Change 3 Months 1937 over 1936	Per Cent of Total Three Months 1937	Per Cent of Total Three Months 1936	Five Months 1937 Models	Five Months 1936 Models	Five Months Per Cent Change
Ford	85,811	61,805	69,271	214,762	163,739	+ 31.0	25.00	23.60	305,843	274,911	+ 11.0
Chevrolet	77,440	29,646	87,541	163,206	203,843	− 20.0	19.00	29.39	306,854	325,064	− 5.7
Plymouth	50,575	39,590	41,186	133,585	94,685	+ 41.0	15.54	13.65	222,988	157,537	+ 41.5
Dodge	28,727	20,863	21,180	71,553	47,525	+ 50.6	8.33	6.85	113,791	80,401	+ 41.1
Pontiac	19,830	8,733	14,559	44,752	31,784	+ 40.9	5.21	4.58	76,851	54,204	+ 41.5
Oldsmobile	18,476	6,791	17,633	40,460	38,548	+ 5.0	4.71	5.56	54,776	66,116	− 2.1
Buick	16,780	6,120	13,100	38,105	28,920	+ 32.0	4.44	4.17	75,790	53,823	+ 41.0
Packard	10,309	6,587	4,739	23,458	10,193	+130.0	2.73	1.47	37,950	18,846	+101.0
Terraplane	8,498	6,181	6,324	21,698	14,712	+ 47.7	2.53	2.12	35,276	24,711	+ 43.0
Chrysler	9,225	5,921	5,006	21,689	11,457	+ 89.5	2.52	1.65	34,010	16,137	+111.0
De Soto	7,998	4,927	3,270	17,998	7,358	+145.0	2.09	1.06	27,163	11,117	+144.0
Studebaker	7,656	4,702	5,703	17,281	12,845	+ 34.7	2.01	1.85	29,584	18,811	+ 57.2
Nash	7,250	4,209	3,657	16,040	6,091	+ 98.8	1.87	1.17	24,442	13,365	+ 82.7
Willys	5,321	3,339	799	11,233	2,287	+392.0	1.31	.33	12,915	4,498	+187.0
La Salle	2,932	884	1,040	6,040	2,322	+160.0	.70	.33	10,512	4,514	+133.0
Lincoln	2,512	1,700	1,016	5,986	2,516	+138.0	.70	.36	9,749	3,488	+179.5
Hudson	1,633	1,208	1,920	4,368	4,908	− 11.0	.51	.71	7,734	9,076	− 14.8
Graham	1,307	901	1,290	3,175	2,980	+ 6.5	.37	.43	5,713	4,812	+ 19.0
Cadillac	1,015	565	1,027	2,731	2,520	+ 8.3	.32	.36	5,084	4,705	+ 8.0
Cord	127	88	82	312	89	+250.0	.04	.01	450	89	+405.0
Auburn	26	42	184	108	560	− 80.7	.01	.08	243	1,068	− 77.3
Pierce-Arrow	29	32	72	99	176	− 43.8	.01	.03	199	328	− 39.4
Miscellaneous	96	139	640	500	1,607	− 68.9	.05	.24	2,105	3,557	− 40.9
Total	363,573	214,973	301,239	859,161	693,665	+ 24.0	100.00	100.00	1,410,024	1,151,178	+ 22.5
Chrysler Motors	96,525	71,301	70,642	244,825	161,025	+ 52.0	28.50	23.21	387,952	265,192	+ 50.0
Ford and Lincoln	88,323	63,505	70,287	220,768	166,255	+ 33.0	25.70	23.97	315,592	278,399	+ 13.3
General Motors	136,473	52,739	134,900	295,296	307,937	− 4.2	34.37	44.39	539,869	508,426	+ 6.2
All Others	42,252	27,428	25,410	98,272	58,448	+ 68.3	11.43	8.43	156,611	99,161	+ 57.8

Buick Adds Dealers

Contemplates Retail Force of 3000 Within Next Six Months

With a gain of 86 dealers during April, a record for any single month, the Buick division of GM Sales Corp. now has the largest dealer organization in its history.

The Buick retail organization in the field now numbers 2756 dealers, the largest group ever to represent Buick. The previous high was in April, 1928.

It appears likely that the dealer force will be further expanded within the next six months until approximately 3000 dealers will be selling and servicing Buick cars in the U. S., according to W. F. Hufstader, sales manager.

The new high mark is the result of steady growth and not a dealership "campaign," the executive said. "It long has been Buick policy not to 'pack' dealers in the larger markets, not to place franchises that could not be justified by the sales potentials in the areas where new representation was wanted," he said.

"With our entry into a lower priced field three years ago, the potential market for Buick cars was greatly enlarged. Retail volume has grown more than four times and is continuing to expand with the prospect that 1937 will be one of the biggest years, from the standpoint of unit sales, in Buick history.

"In 1933 a total of 43,000 Buick cars was retailed in the U. S., the volume rose to approximately 65,000 in 1934; in 1935 a domestic retail volume of approximately 92,000 cars was reached, while in 1936 we delivered 165,000 cars. Thus far the 1937 volume exceeds that of last year by more than 25 per cent with an unprecedented demand that taxes the limit of production capacity.

"This tremendous increase in sales has been accomplished with only a nominal increase in the dealer organization, which at its lowest point numbered 2029 dealers and which is at an all-time high of slightly over 2700."

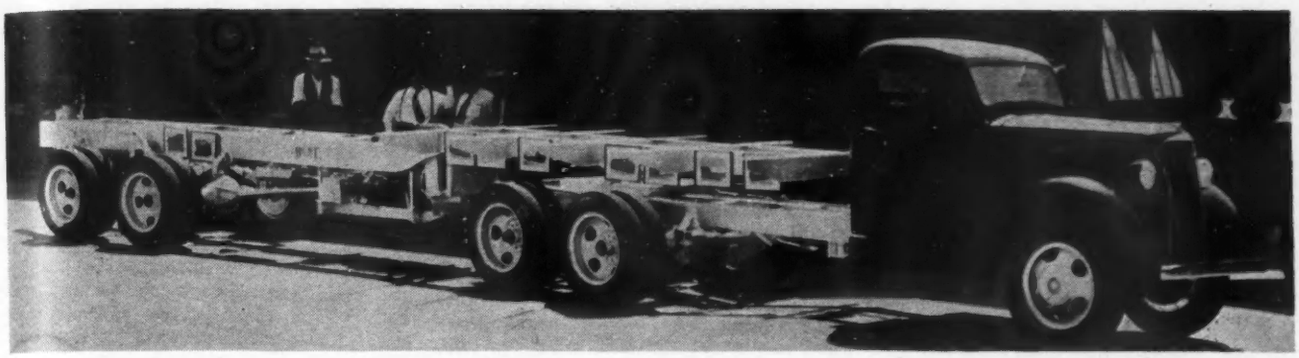
New Truck Registrations

	March 1937	February 1937	March 1936	Three Months 1937	Three Months 1936	Per Cent Change 3 Months 1937 over 1936	Per Cent of Total Three Months 1937	Per Cent of Total Three Months 1936
Ford	20,839	16,460	16,168	53,843	43,000	+ 25.0	35.96	31.50
Chevrolet	17,164	7,939	19,511	39,485	49,613	− 20.5	26.36	36.35
International	5,820	5,256	5,395	17,320	14,503	+ 19.3	11.57	10.63
Dodge	6,498	5,043	6,751	15,305	18,514	− 17.3	10.22	13.56
G. M. C.	4,201	3,051	1,551	10,072	2,737	+268.0	6.73	2.01
Diamond T	849	602	634	2,314	1,639	+ 41.0	1.55	1.20
Plymouth	1,140	714	231	2,070	612	+239.0	1.38	.45
White	566	367	358	1,412	1,060	+ 33.2	.94	.78
Mack	480	384	184	1,233	381	+224.0	.82	.28
Terraplane	547	361	141	1,193	294	+306.0	.80	.22
Reo	495	317	264	1,166	820	+ 42.1	.78	.60
Studebaker	478	222	221	869	498	+ 74.3	.58	.36
Federal	241	206	205	654	598	+ 9.3	.44	.44
Autocar	179	112	88	421	220	+ 91.4	.28	.16
Indiana	89	183	119	385	318	+ 21.0	.26	.23
Brockway	140	115	127	357	309	+ 15.5	.24	.22
Stewart	149	101	73	342	220	+ 55.6	.23	.16
Willys-Overland	76	57	143	256	463	− 44.3	.17	.34
Divco	83	94	64	257	150	+ 71.1	.17	.11
Stutz Pak-Age Car	44	41	...	157	...	...	.10	...
F. W. D.	32	48	48	122	104	+ 17.2	.08	.08
Sterling	23	28	17	78	29	+169.0	.05	.02
Kenworth	28	3	...	39	...	...	.03	...
Schacht	10	4	...	20	...	...	.01	...
Miscellaneous	120	129	135	363	407	− 10.8	.25	.30
Total	60,291	41,815	52,428	149,715	136,489	+ 9.6	100.00	100.00

Casing Production Gains

Shipments of pneumatic casings during the month of February are estimated at 4,370,630 units, a decrease of 3.1 per cent under January but 36.1 per cent above shipments made in February, 1936, according to statistics released by the Rubber Manufacturers Association, Inc.

The organization estimates production of pneumatic casings for February at 5,245,894 casings, an increase of 5.3 per cent over January and 46.6



BOOSTER auxiliary makes possible maintenance of fair speeds with moderately powered tractor-semi trailer trains on long up grades. Best Trailer Co., Los Angeles, Calif., designed the unit pictured here with an auxiliary powerplant which can be started at the foot of a long rise when the train is loaded, and shut down when the summit is reached. When the auxiliary powerplant is in operation the train consists virtually of two motorcars connected in series, and in order that the load may be equally divided between the two engines it is necessary that throttle control and gear shifting be completely synchronized. Throttle control, clutch operation, and gear shifting are accomplished from the driver's cab on the tractor by means of the usual control members in conjunction with hydraulic mechanisms. The auxiliary powerplant on the semi trailer is underslung from the frame of the semi trailer sufficiently far back so as not to interfere with relative angular movement of tractor and trailer. Starting of the auxiliary powerplant is accomplished by means of a switch on the instrument board of the tractor which acts through a "Startix" on the trailer. For the present, these tractor-trailer trains will be equipped with Ford and Chevrolet powerplants only, both the tractor and the trailer receiving similar engines. Tractor and semi-trailer have dual rear axles but both drive only through the wheels on the forward one of the two rear axles. As regards the legal status of this type of transportation equipment, we are informed that the State of California has agreed to register the trailer as non-power equipment, and therefore tax-free, for the next two years at least.

per cent above February, 1936.

Pneumatic casings in the hands of manufacturers, Feb. 28, 1937, are estimated at 12,307,681 units, an increase of 8.2 per cent over the stocks on hand Jan. 31, and 32.8 per cent above stocks on hand Feb. 29, 1936.

Pneumatic Casings

	Shipments	Production	Inventory
Feb., 1937	4,370,630	5,245,894	12,307,681
Jan., 1937	4,509,240	4,980,174	11,377,015
Feb., 1936	3,211,654	3,578,627	9,264,581
Feb., 1935	3,287,394	4,382,663	11,529,561

Continental Motors' Sales Up

Continental Motors Corp, is showing a substantial increase in sales this year, according to W. R. Angell, president. For the six months ended April 30, the first half of its fiscal year, sales totaled $4,360,000 compared with $2,968,000 in corresponding period of preceding year, a gain of 47 per cent. Unfilled orders at the factory on April 30 amounted to $2,650,000.

April Banner Month for Pontiac

Sales of Pontiac cars throughout the U. S. during April were 25,064 which was the biggest April on record for Pontiac and was exceeded only by March of this year when 25,964 cars were delivered.

The slight decrease in April is explained by the fact that the plant was closed for the first three days of the month due to shortage of parts from plants affected by strikes.

This record April sales figure compares with 19,481 for April of 1936.

April also was the largest used car month in the history of Pontiac dealers with sales amounting to 40,346.

Unfilled orders for new cars increased during the month which was the seventh consecutive month they have gone up.

New Link Factory in Canada

Completion of arrangements for manufacturing Link Aviation Trainers at Gananoque, Canada, has been announced by E. A. Link, president, Link Aviation Devices, Inc., Binghampton, N. Y. The new plant consists of a three-story brick factory with warehouse, having 30,000 sq. ft. of floor space. Machinery has been ordered and it is expected that production will begin within a few weeks.

The Canadian factory will be used to produce Trainers for shipment to England and other foreign countries. R. Whatham, vice-president, J. V. W. Corp., Newark, N. J., exclusive agent for Link Trainers, has just returned from two months' stay in Europe where he negotiated the contract for a substantial number of Trainers for the British Air Ministry.

AFL Criticizes

(Continued from page 711)

published in the federation's monthly review.

It was asserted in the bulletin, prepared under direction of federation president William Green, that it is possible for basic industries to lower prices despite wage increases. To confirm the view, records were cited of a large concern employing over 200,000 workers which did not boost price of its product materially. Although not identified by the federation, the General Motors Corp. was apparently being referred to according to the figures presented.

"In the case of this firm," the bulletin stated, "a 64 per cent increase in production plus increased efficiency raised the value produced by the average worker from $1,873 to $2,661 in two years, a gain of $788 per worker employed."

Six GM Plants Close In Week: 16,000 Are Temporarily Out

Strikes closed six GM plants this week and threw some 16,000 employes temporarily out of work. The Gray Iron Foundry in Saginaw shut down Tuesday and on Wednesday the Malleable Iron and the Chevrolet parts plants were forced to close. Fisher Body and Chevrolet plants at Janesville, Wis., closed Wednesday after demonstrations in both factories. The Fisher plant at Cleveland closed Thursday morning.

Union headquarters stated that the strikes were caused by various grievances but expected the situations to be cleared up promptly.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

The Flying Machine

By A. M. Herring

In the general mind the flying machine is almost universally associated with some form of cigar-shaped balloon; but it is, however, scarcely within the range of probability that the flying machine of the future will possess any of the characteristics of the balloon. Instead of being lighter than air, it will doubtless be hundreds, perhaps thousands of times heavier, volume for volume, and instead of depending on gas for its support, it will rest upon the air only while skimming rapidly through it, at speeds equal to but not many times greater than that of our fastest railway trains.

The transforming of a small horizontal force (the push of screws—for it takes a very great expenditure of power to produce a moderate screw thrust in air) into a much larger lifting effect is the main advantage which the aeroplane has over the vertical screw, an advantage which makes the one type possible and the other not.

—From *The Horseless Age*, May, 1897.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

The upward trend in general business activity continued last week, with several lines registering new highs for the movement. The weekly business index compiled by the "Journal of Commerce" stood at 105.1, as against 104.1 the week before and 90.4 a year ago. Retail buying increased from 8 to 25 per cent above that in the corresponding period last year, while wholesale business gained from 18 to 35 per cent.

Car Loadings Increase

Railway freight loadings during the week ended May 1 amounted to 782,423 cars, which marks an increase of 21,241 cars above those in the preceding week, a gain of 111,535 cars above those a year ago, and a rise of 203,496 cars above those two years ago.

Retail Food Costs Advance

There was an advance of 0.3 per cent in retail food costs between March 16 and April 13, according to the Bureau of Labor Statistics. Of the 84 items included in the index, 56 increased, 24 declined, and 4 remained unchanged.

Electrical Production Up

Production of electricity by the electric light and power industry in the United States during the week ended May 1 was 13.5 per cent above that in the corresponding period last year.

Living Costs Average Higher

Living costs for wage earners in the United States on March 15 averaged 1.7 per cent higher than those on December 15, according to the Bureau of Labor Statistics. Particularly large advances were noted in the costs of food and house-furnishing materials. Living costs on March 15 were 12.5 per cent above the low point of June, 1933.

Farm Prices at Peak

The index of farm prices compiled by the Bureau of Agricultural Economics during the week ended April 15 stood at 130, as against 128 a month earlier and 105 a year ago. The current index is the highest for any April since 1930.

Fisher's Index Down Slightly

Professor Fisher's index of wholesale commodity prices for the week ended May 8 stood at 93.3, as against 93.5 the week before and 93.8 two weeks ago.

Reserve Holdings Gain

The consolidated statement of the Federal Reserve banks for the week ended May 5 showed an increase of $6,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and of government securities remained unchanged. The monetary gold stock increased $56,000,000, and money in circulation rose $45,000,000.

News from Nippon

Aircraft Enterprise Hampered By Skilled Labor Shortage

Announcements have been made of new enterprises in the Japanese aircraft industry and at least three companies now organized aim to produce aircraft in complete form. These companies are expected to meet with considerable difficulties, and American aircraft concerns are reported less disposed to release licenses or admit foreigners to their workshops. Models, for which manufacturing license was acquired years ago, are now obsolete. The Army and Navy, with several factories on their approved list such as the Nakajima Aircraft Co. and the Tokyo Gas & Electric Industry Co., apparently are disinclined to supply skilled men trained under their direction.

The Tokyo Tanko Sho (Tokyo Forging Works) recently recapitalized at 1 million yen ($285,000), will further increase its capital to 1.2 million yen ($345,000). The manufacture of crankshafts and other forged parts for Toyota is the objective.

The Shinagawa Dock Co. (capital 1 million yen) is completing a new plant for the manufacture of automobile frames.

The Toyota Automobile Co. is preparing to place large orders for machinery. The Mitsui Bussan New York branch, through its special relation with the Toyota interests will handle all installations of American origin.

Exportation of rubber belts is now expected to be placed under export control. Cable-corded vee-belts, a specialty of many Japanese rubber concerns, have opened up considerable market in foreign countries. The belts were originally manufactured to specifications of the Ford Motor Corp. for use on fan pulleys of Ford automobiles. Passing tests of the Ford laboratories, the cable-corded vee-belt of the Yokohama Rubber Co. was recommended as standard equipment on Ford cars.

Hupp Plans

To Spend $360,000 on Tools and Dies if Refinancing is Successful

If the refinancing plan undertaken by the Hupp Motor Car Corp. is successful, the proceeds to the corporation will be $2,690,000, according to the prospectus being mailed to present stockholders. Of this amount, approximately $35,000 would be devoted to plant reconditioning, and about $360,000 for additional tools, jigs and dies in a production program which contemplates a varied six-cylinder line and an eight-cylinder line of four-door deluxe sedans only. Production activity is planned as soon as practicable after the completion of the financing program, and the corporation hopes to have cars on the market in time for the autumn announcement season.

The prospectus offers present stockholders the right to subscribe to 1½ shares of new stock at $3 ($1 par value) for each share of converted stock now held. Warrants for purchase of the new stock must be exercised before May 24, to obtain the $3 price.

Among details in the prospectus of the corporation's past and present activities it is revealed that a Hupp subsidiary is the owner of 50 per cent of the outstanding capital stock of the Ray Day Piston Corp., Detroit.

Willys Tops Record

Production Reaches 38,421 Cars With April Peak of 9819

Showing a fourth consecutive monthly gain, and establishing a new monthly record with an output of 9819 cars in April, total output of 1937 Willys models reached 38,421 units as of May 1.

April production was 4.5 per cent greater than that of the preceding month which had been the record month since production of the new models began last fall.

The factory sales division reports all cars being shipped at the close of each day's manufacture, with advance orders still exceeding production schedules.

Twenty-three hundred dealers are participating in a nation-wide sales campaign calling for 1,000,000 Willys demonstrations in seven weeks. The dealers have been supplied with 2000 deluxe sedan models, with bright yellow bodies and green fenders, which are being used in the demonstration program to continue until June 7.

:SLANTS:

FUTURE FARMERS—*Using its 37,000-acre ranch at Litchfield Park, Ariz., as a training ground, the Goodyear Tire and Rubber Co. has launched on organization known as the "Future Farmers' Flying Squadron," which will provide an all-around, three-year training course in practical and theoretical farming for its members. At the conclusion of their training, squadron members who have proved their ability to support themselves in agricultural pursuits, will be given the opportunity to purchase their own tracts of land and establish themselves as independent farmers. That the Goodyear ranches are ideally suited to such an enterprise is indicated by the fact*

that long-staple Pima cotton, citrus fruits, alfalfa, cattle—all are included in its products. In recent years the ranch has also served as a proving ground for pneumatic tires on tractors and various other farm implements. For the purpose of the experiment, conceived by P. W. Litchfield, Goodyear president, 12 young men, between the ages of 19 and 24, have been selected and now are undergoing their initial training. Application of supervised, scientific training methods to develop the prospective farmers, occurred to Mr. Litchfield as a result of the success achieved with the Goodyear factory "Flying Squadron" which he originated and organized in 1913. This group, benefited by a three-year course in operations of the rubber industry and augmented annually by a limited number of selected men, has proved an important factor in the maintenance of balanced production at Goodyear.

Ford Motor Co., Ltd., of Great Britain, reported net income for 1936 of £497,693 against £597,153 for 1935. The earnings do not include any profits earned by, or dividends from shares held by subsidiaries.

Automotive Metal Markets

Avoidance of Price Excesses Dominates Seller Sentiment; Steel Activities Continue Satisfactory

Moderation on the part of the executives who shape price policies of important metal producing companies is more and more in evidence. Nothing in recent days has heartened consumers as a statement by one of the largest sellers of copper to the effect that 17 cents a pound for the metal, price that prevailed early in April, was too high and "uneconomic." This spokesman for the conservative wing of the copper industry voiced the opinion that "too high prices might kill the goose that lays the golden eggs" and pointed to the average of 12½ cents over a period of years as normal.

This striving to hold prices in check has been more or less in evidence in all metal markets in recent weeks, steel being no exception. Even in the market for pig iron those who counsel avoidance of price excesses appear to be gaining the upper hand over sellers who believe that heavy inquiry from abroad justifies an all-around mark-up.

Steel mill activities continue highly satisfactory, except for the threat of strikes in several of the "independents'" plants. Possibility of interrupted production, as the result of CIO tactics, has had no effect so far on the attitude of automotive consumers who continue to place orders and to issue shipping instructions in strict conformity with their own production schedules.

Sheet mills, while reducing their backlogs, are for the most part operating 16 turns a week, considerably above their average rate. Strip mills, that had not accumulated as much in the way of unfilled tonnage as sheet mills, make up for this by a somewhat higher rate of new business from parts makers and automobile manufacturers. After all, backlogs can be largely ornamental. What counts are billings. And these, for the present, continue to make a very satisfactory showing.

Pig Iron—Shipments to automotive foundries continue at a fairly high rate. The market seems to take for granted that no definite action will be taken with reference to third quarter prices before the end of May. The $3 per ton decline in scrap from the April highs has not been without influence on pig iron market sentiment.

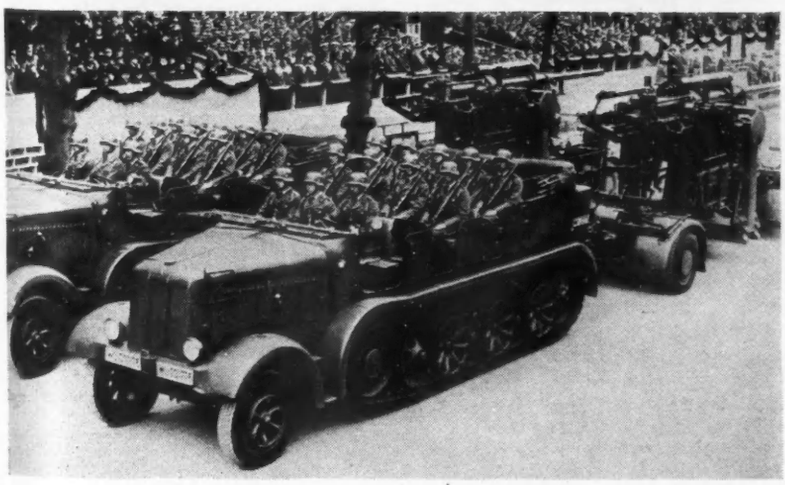
Aluminum—Secondary aluminum prices are holding steady, reflecting for the most part sustained routine demand. The market for primary metal is unchanged.

Copper—The market has settled down to a sort of humdrum flatness, consumers showing but little interest in offerings at 14 cents. Export prices, however, have improved fractionally and are now sufficiently above the 14-cent domestic price, to furnish somewhat of a prop for this level.

Tin—Holidays in London made for lack of guidance from that and the Eastern markets, with the result that the price movement turned tame. Spot Straits was quoted at the week's opening at 55¼ cents, but sagged to 54¾ cents on Tuesday, inquiry being decidedly light. Report has it that Bolivia will in the near future augment its tin output, differences between producers and the government of that South American republic being about to be settled.

Lead—Demand from the storage battery trade is the market's feature. Prices are unchanged and the tone is steady.

Zinc—Quiet and unchanged.



PEACEFUL was the dinner of the U. S. Army Ordnance Association, held in Washington May 12. Hilaire Belloc, British author and publicist, told assembled ordnance officers and industrialists that "Yesterday's War is Not Tomorrow's." Proof of the statement was made visual during an ordnance demonstration of new equipment at the Aberdeen (Md.) proving ground on the following day. Additional proof (Japanese) is seen in the top picture, which shows huge tractor trucks used to haul field pieces in recent Japanese army maneuvers; and (German) in the lower picture, which shows tractor-drawn artillery units passing through Berlin's Tiergarten during the impressive military parade staged in honor of Chancellor Hitler's forty-eighth birthday.

ASTE Appoints Ford Lamb New Executive - Secretary

According to recent announcement by the American Society of Tool Engineers, Ford Lamb, past president and one of the founders of the ASTE was appointed executive-secretary of the society.

Incoming national officers inducted at the recent meeting in Toledo include the following: Frank A. Shuler, master mechanic, Chrysler Corp., president; Luke E. Beach, first vice-president; Walter F. Wagner, second vice-president; Frank R. Crone, treasurer, and C. Ray Brunner, secretary.

SPORTS provided entertainment for SAE members and guests one afternoon at the White Sulphur Springs session and several hundred gathered on the Greenbrier's greensward to watch the fun. The gentleman with the hat is Fred M. Young, president, Young Radiator Co., and the others—apparently engaged in serious conference—are John A. C. Warner, secretary and general manager of the SAE, and Col. Herbert W. Alden, chairman of the board, Timken-Detroit Axle Co.

SAE Discusses Fuels and Lubricants

(Continued from page 713)

specifications and classification of chassis lubricants before any simplification will be possible.

E. W. Upham of Chrysler was quite sympathetic with Larson's proposal. He recommended specification materials for the initial factory filling and then the use of SAE practice for service. His most important point was a request for an SAE number to identify greases and lubes, rather than trade names or commercial terminology, using a viscosity grading for the purpose.

W. S. James, Studebaker chief engineer, emphasized that the problem of the car manufacturer is to hold down variety of specifications in the interest of better distribution. He stated that axle performance depends largely upon axle design and predicted changes in hypoid axle design to further reduce deflection and reduce tooth loading.

Perhaps the most vehement objection to Larson's recommendations came from J. A. Moller of the Pure Oil Co. He indicated that the proposal was not sufficiently broad and did not cover the range of types of lubricants required to service the gamut of cars on the road. On the matter of hypoid lubes, Mr. Moller said that the Lubricant was by no means the weak link in the axle problem. He suggested that axle design and the manufacturing process must be considered and related to the study of lubrication. He showed that the old, discarded black lubes pronounced as worthless in 1927 are back again as E-P lubes with the addition of lead soaps.

As the result of much laboratory and road testing, Mr. Moller's organization has found that the powerful E-P lubes result in considerable abrasion in the first 1000 miles, as measured by backlash. Then the abrasive action ceases and their study seems to indicate that after this period, the powerful E-P loses its characteristics and becomes a mild E-P without further corrosive tendencies.

J. B. Macauley of the Chrysler Corporation announced that the semi- annual motor gasoline survey, which in former years was conducted by the Bureau of Mines but was discontinued during the depression, would be resumed, and the next survey would be published about July 1. The information would be gathered by the concerns marketing motor fuels in the U. S. A. and would be furnished to the Bureau of Mines through the Cooperative Fuel Research Committee. It would cover the three principal grades: premium, regular and third grade. Two surveys will be conducted per year, one covering summer and the other winter grades of gasoline.

In connection with the motor gasoline survey a motor survey will be undertaken to determine the fuel requirements of present-day gasoline engines. This will cover two points, namely, the fuel of minimum octane number which the engine can be run on satisfactorily, and the maximum permissible vapor pressure to prevent vapor lock. The information will be published under the C.F.R. imprint.

Additional excerpts from papers presented at the meeting appear on page 737 of this issue of AUTOMOTIVE INDUSTRIES.

Test Trek

Texaco Sponsors 25,000-Mi. Grind for 12 Production Cars

Twelve automobiles, representing by types approximately 95 per cent of the industry's output, started from Detroit on May 15 on a 25,000-mi. test arranged by the Texas Co. in cooperation with the chief engineers of a dozen motor factories.

This is the second annual drive conducted by Texaco for the collection of information pertaining not alone to lubrication and fueling of automobiles but to performance of the cars themselves. Each day during the four months of the tour, chief engineers of Buick, Chevrolet, Chrysler, Dodge, Ford, Lincoln, Oldsmobile, Packard, Plymouth, Pontiac, Studebaker and Hudson-Terraplane will receive confidential reports of accumulated technical data. Goodrich, Goodyear and Firestone tires will also come in for study.

The test cars, to be operated under the direction of William Harrigan of the technical division of the Texas Co., are fitted with the latest automotive recording devices and an observer in each vehicle will make 44 notations every 15 minutes while the cars are on the road. The recordings include temperature readings of 20 vital points in the automobile such as engine bearings, transmission and over-drive gears, carburetor float-bowls, fuel pumps, steering gear, intake manifold and oil filter.

Prior to the start of the test fleet,

G. WAINE THOMAS, employed by Reo Motor Car Co. for the past 11 years in truck and bus engineering capacities, has been appointed to the post of chief engineer.

ROBERT H. AHLERS, associated with the Delco Products Div. of General Motors for the past 23 years, has been given the newly created position of assistant general plant manager of Pontiac.

C. B. THOMAS has been named general sales manager of the Chrysler Corp., Export Division.

HYMAN BORNSTEIN, chief chemist and metallurgist of Deere & Co., Moline, Ill., has been elected president of the American Foundrymen's Association for the 1938 term.

W. HERBERT BRETZLAFF, for the past four years vice-president in charge of national account sales for E A. Laboratories, has been appointed vice-president of the Defiance Pressed Steel Co.

H. O. K. MEISTER, new general manager of the Hyatt Bearing Div. of General Motors at Harrison, N. J., has been appointed to that office to succeed the late H. J. Forsythe.

J. F. MAXWELL, formerly assistant service manager of Federal Motor Truck Co. and for several years technical service representative on the Pacific Coast, has rejoined the company in the capacity of service manager.

headed first through the North Atlantic states, each automobile was dismantled and a close check was made of all parts subject to wear. This involved the measuring and, in many cases, the weighing of parts so that upon completion of the itinerary the cars can be again dismantled for determination of wear under practical experimentation.

Aside from the regular road travel which will include elevations as high as 14,000 feet and depressions down to 270 feet below sea-level, the cars will be speed tested at Daytona Beach and on the Bonneville salt flats of Utah.

Vehicle Distribution Expenses Lowest According to '35 Census

Distribution expenses in the transportation equipment market, dominated largely by motor vehicles, are considerably below those for other large-industry groups, according to a study just published by the Bureau of Census, as part of the 1935 Census of Business.

In 1935 total distribution expenses for the transportation equipment industry took $63 million out of gross sales of $1,993 million by 540 plants reporting to the Census. In percentage of sales (3.2) this compares with a percentage of 12.5 for the miscellaneous group, 15.2 for the chemical and allied products group, and 7.4 for the petroleum and coal products group, which was nearest to the transportation group in keeping distribution expenses down. The average of all industries was 9.4 per cent.

Of the $63 million total distribution costs, $23.6 million were used to meet the annual distribution payroll, while the remaining $40.1 million accounted for the other distribution expenses such as traveling expenses of salesmen, advertising, credit, etc.

For the 86 Motor Vehicle plants who reported net sales of $1,564 million, sales expense amounted to $45.7 million or only 2.9 per cent.

International News Photo

LABOR CONFERENCE in Washington, D. C., last week was attended by Alvan Macauley, president, Packard Motor Co., and T. G. Graham, vice-president, Goodrich Co., pictured above left to right, who discussed relations between industry and labor with Secretary of Labor Frances Perkins. One resolution emerged from the session, which in effect, urged co-operation for peaceful solution of disputes. Miss Perkins again suggested increased mediation facilities in the different State Labor Departments and assignment of experienced conciliators of the Federal Department of Labor to cooperate with the States when industrial differences arise.

Classify Air Accidents

Over Half Million Miles Flown Per Fatality

Aircraft operators, classified in a miscellaneous group, flew 523,266 miles per fatal accident and 644,145 miles per passenger fatality in the six months from July to December, 1936, according to an announcement of the Bureau of Air Commerce, Department of Commerce.

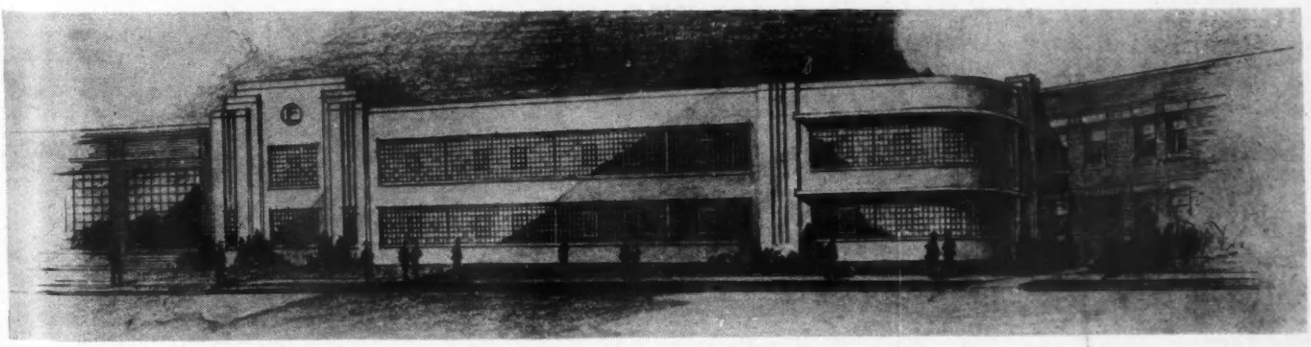
Operators in this category, which includes flying services, schools, specialists in photographic flying, crop dusting and private flyers, suffered 909 accidents during the period in 51,803,290 miles of flying. Miles flown per accident were 56,989.

Causes of accidents in miscellaneous flying during the last half of 1936 were divided as follows; personnel errors, 55.58 per cent; powerplant failures, 15.16 per cent; airplane failures, 11 per cent; weather, 6.58 per cent; darkness, 0.74 per cent, airport, water or terrain, 7.38 per cent; other causes, 3.01 per cent; undetermined and doubtful, 0.55 per cent.

Plan Palatial Trailer Park

Plans are being discussed for a trailer camp near the intersection of the Boston Post Road and the Hutchinson River Parkway, just north of New York City and within easy reach of the site of the New York World's Fair of 1939, it was announced by Bronx Borough President J. J. Lyons.

The camp would cost $3,000,000. Plans involve a nominal lease of the ground from a realty subsidiary of the Curtiss Wright Corp., which had projected an airport there.



NEW LABORATORY for research and engineering activities of the Eaton Manufacturing Co. will be added to the company's office building and plant in Detroit. First floor of the modern two-story structure will house five dynamometer rooms. A drafting room, research and experimental laboratories and engineering offices will be placed on the second floor. It is expected that the new building will be ready for occupancy in August. In announcing awarding of construction contracts, C. I. Ochs, president of the Eaton Company, stated "This expansion of our facilities will enable us to broaden the scope of our experimental and development work in the automotive and aircraft fields. Particular emphasis will be placed upon experimental engineering in connection with the valves, valve tappets and valve seat inserts made by our Wilcox-Rich Division."

Latest issue of "Grits and Grinds," a publication of the Norton Co., Worcester, Mass., is devoted to the subject of **metal polishing.***

A bulletin describing the application of Oakite airefiner for **bacteria control in air conditioning** has been brought out by the Oakite Products, Inc., New York City.*

The Brown Instrument Co., Philadelphia, Pa., has just published a catalog on its complete line of **millivoltmeter pyrometers.***

"Perfect Oil Cleaning Job at Lower Cost" is the title of a new pamphlet describing the H-W and Michiana **oil filter.** It was issued by the Michiana Products Corp., Michigan City, Ind.*

P. R. Mallory & Co., has just issued a comprehensive engineering pamphlet on **bimetallic thermostatic elements.**

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Motor Wheel Dividend

The board of directors of Motor Wheel Corp. has declared the regular quarterly dividend of 40 cents per share on the common stock, payable June 10, 1937, to stockholders of record at the close of business May 20, 1937.

Crack World's Records

Britishers Set New 24-Hr. Marks At Montlhery Track

With a total distance of 2329.2 miles, average 97.05 m.p.h., G. E. T. Eyston and Albert Denly broke the world's 24-hr. heavy oil engine record, on Montlhery track, near Paris. The two Britishers also secured the world's 12-hr. record, with an average of 99.03 m.p.h., also world's records for 1000 kilometers, 1000 miles, 3000 kilometers and 2000 miles.

Making a separate run, Eyston secured the world's hour record with a speed of 105.597 m.p.h. The highest speed attained was 106.27 m.p.h., constituting the world's 50 kilometer record. In all cases the competitor broke his own records, the previous best for the 24 hours being 94.99 m.p.h.

The car used for this performance was an open job equipped with a six-cylinder A.E.C. engine of 115 by 146 mm. bore and stroke, similar in all essentials to those used on London buses. It is equipped with the Bosch injector. The Dunlop tires were changed every three hours.

French Automotive Society Celebrates Tenth Birthday

Founded in 1927, the French Society of Automotive Engineers (S.I.A.) recently celebrated its tenth anniversary by a dinner at the Cercle Interallié, Paris, attended by members of the government and leaders of the French automotive industry.

M. Pierre Prévost, the acting president, paid a tribute to the first two presidents of the society, M. Mathieu and M. Maurice Goudard. The French society now numbers about 1000 members and has secured a strong position in the industry.

It has just been decided to add an aeronautical section to the S.I.A., the president being Charles Waseige, who for a number of years was chief of the engine department of the Farman Aviation Company.

Autocar at Hagerstown, Md.

A new branch has been opened by the Autocar Co. at Hagerstown, Md., with J. M. MacHale appointed as manager. The Hagerstown branch will operate as part of the Baltimore district, where A. H. Bishop, vice-president, is in charge.

Sperry Lists 66,454 Shares

The Sperry Corp. has been authorized by the New York Stock Exchange to list 66,454 shares of common stock of $1 par value in order to acquire the common stock and most of the preferred stock of Vickers, Inc., Detroit, manufacturers of hydraulic pumps and transmissions.

Calendar of Coming Events

SHOWS

Second Annual Automobile Maintenance Show, San Francisco.....May 20-23
Morocco, Automobile Section, Tangier Fair, Tangier .....June
France, Automobile Section, Bordeaux Fair, Bordeaux .....June 13-28
Belgium, First International Aeronautical Salon, Brussels.....June 18-30
Fourth ASTM Exhibit of Testing Apparatus and Related Equipment, New York .....June 28-July 2
Poland, Automobile Salon (Foire Orientale), Lwow .....Sept. 1-15
France, 31st International Automobile Salon, Paris .....Oct. 7-17
Great Britain, 31st International Automobile Exposition, London....Oct. 14-23
Czechoslovakian Automobile Show, Prague .....Oct. 16-24
National Automobile Show, New York, Oct. 27-Nov. 3
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Buffalo, N. Y., Automobile Show, Oct. 30-Nov. 6
Cincinnati Automobile Show.Oct. 31-Nov. 6
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London...Nov. 4-13
Chicago Automobile Show.....Nov. 6-13
Akron Automobile Show.....Nov. 6-12
Omaha Automobile Show.....Nov. 6-11
Brooklyn Automobile Show.....Nov. 6-13
Columbus Automobile Show.....Nov. 6-13
Detroit Automobile Show.....Nov. 6-13
Kansas City, Mo., Automobile Show, Nov. 6-13
Motor Truck Show, 4th Annual, Newark, N. J.....Nov. 6-12
Newark, N. J., Automobile Show..Nov. 6-13
Philadelphia Automobile Show....Nov. 6-13

Show Business

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

Pittsburgh, Pa., Automobile Show.Nov. 6-13
Toronto, Ont., Automobile Show..Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20
Baltimore, Md., Automobile Show, Nov. 13-20
Cleveland, Ohio, Automobile Show, Nov. 13-20
Jersey City, N. J., Automobile Show, Nov. 13-20
Milwaukee, Wis., Automobile Show, Nov. 13-20
Springfield, Mass., Automobile Show, Nov. 14-20
St. Louis, Mo., Automobile Show.Nov. 14-21

CONTESTS

Indianapolis Speedway, 500-Mile International Sweepstakes .....May 31
31st Annual Grand Prix of the Automobile Club of France, Linas-Montlhéry .....July 4
Roosevelt Raceway, 400-Mile George Vanderbilt Cup Sweepstakes.....July 5
National and International Soap Box Derby Finals, Akron, Ohio.....Aug. 15
Pan American Cup Race, Roosevelt Raceway .....Sept. 6
National Outboard Championship Regattas, Richmond, Va.....Sept. 18-19

CONVENTIONS AND MEETINGS

American Society of Mechanical Engineers, spring convention, Detroit, May 17-21
National Association of Purchasing Agents, 22nd Annual Convention, William Penn Hotel, Pittsburgh, Pa. .....May 24-27
American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Colo. .....June 1-3
Second World Petroleum Congress, Paris, France .....June 14-19
Automotive Engine Rebuilders Association, 15th Annual Convention, Chicago .....June 21-24
American Society for Testing Materials, 40th Annual Meeting, New York, June 28-July 2
American Transit Association, 56th Annual Convention, White Sulphur Springs, W. Va.....Sept. 19-23
S.A.E. Fuels and Lubricants Regional Meeting, Tulsa, Okla. ...Sept. 30-Oct. 1
S.A.E. National Aircraft Production Meeting, Los Angeles, Calif.....Oct. 7-9
S.A.E. Annual Dinner, Commodore Hotel, New York.....Oct. 28
American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago .....Nov. 9-12
S.A.E. National Production Meeting, Flint, Mich. .....Dec. 8-10

Photo courtesy Tennessee Eastman Corp.

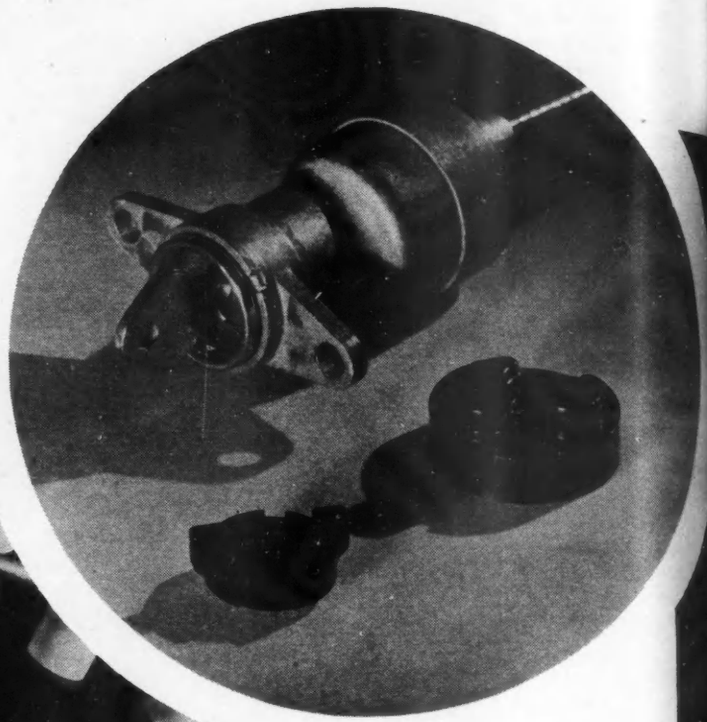
Automotive Materials

3

RECOGNITION of appearance as a vital factor in public acceptance of production passenger vehicles has resulted in increasing utilization of plastic materials by automobile body designers. The manufacturers of plastics, stimulated by huge market possibilities for their product, are constantly developing and improving these molding materials not only for decorative purposes but also for wide application to working parts on automobiles.

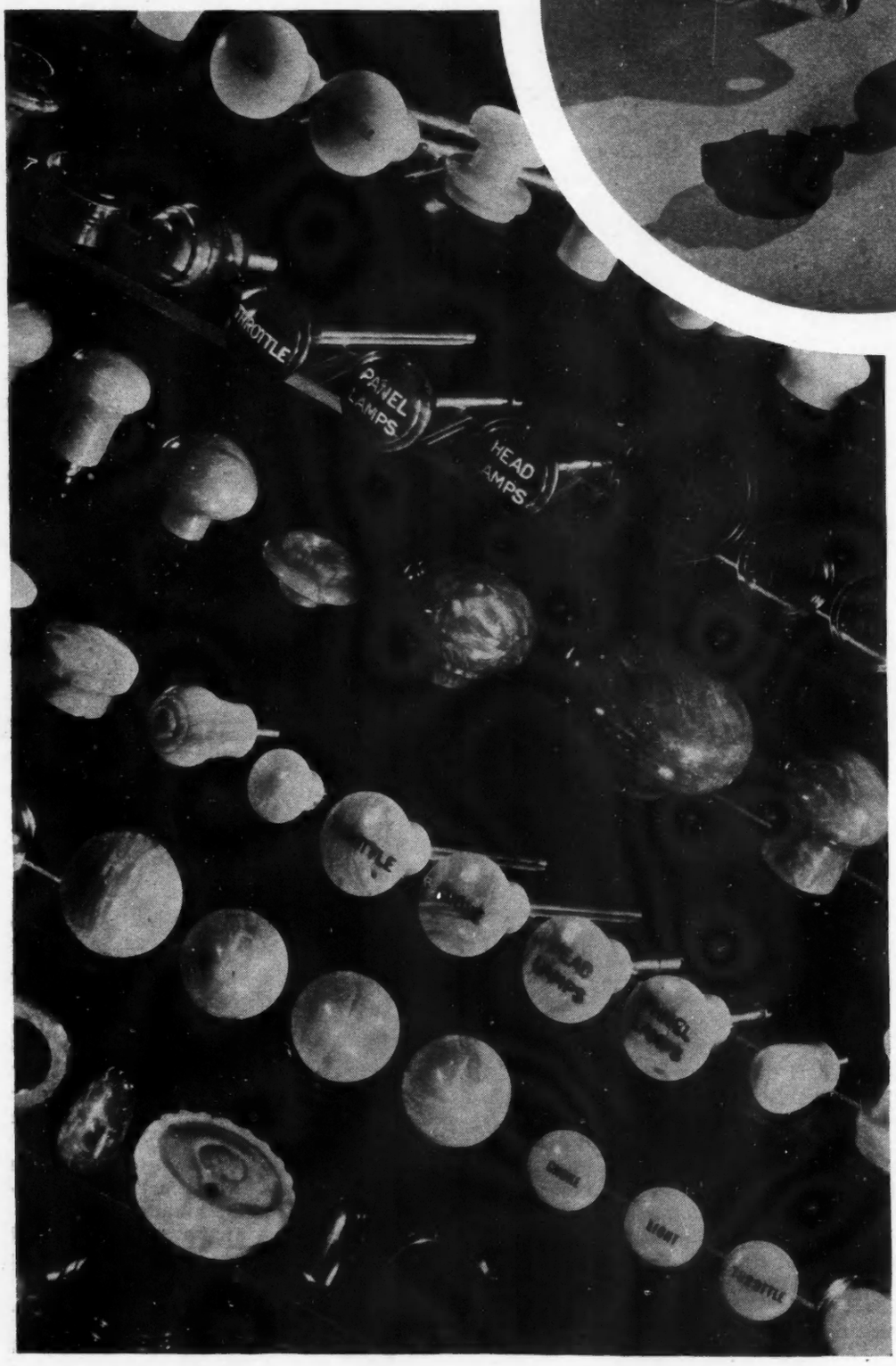
This month we present the third feature article in the Automotive Industries series on materials in which recent developments in plastics, particularly those adapted for use in the automobile industry, are thoroughly described. A section devoted to reports on recent developments in various types of materials is appended to the feature story.

In each third issue of the month we shall continue to give feature treatment to new developments in automotive materials. Heavy casting materials will be discussed in the issue for June 19.



Phenolic molded parts employed in ignition switches as made by the Mitchel Specialties Co.

(Photo by courtesy of the General Electric Co.)

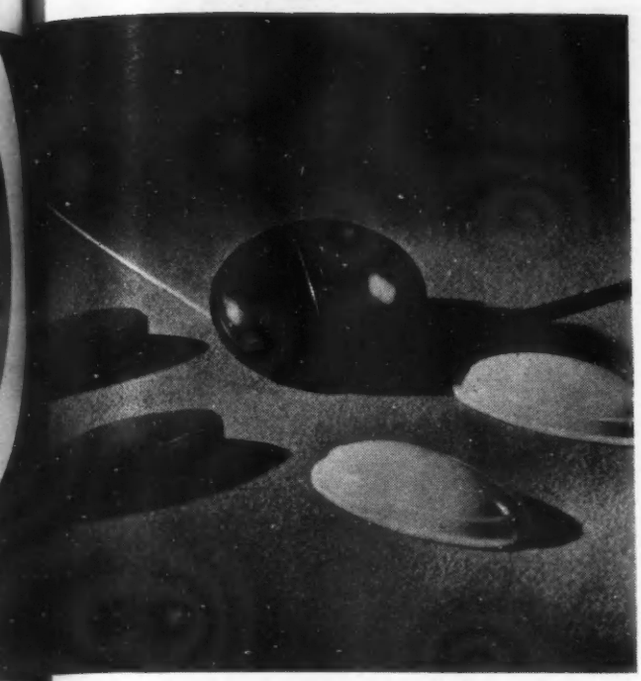


At the top of the facing page are shown horn buttons and door trim in gray and dome light lenses in translucent ivory. These were molded for the Ford line from nonfading urea plastics

(Photo by courtesy of the Plaskon Co., Inc.)

(Left) Here are the fittings of a considerable number of automobiles using Tenite

Molded plastics are filling a big place in the automotive horizon today. The wide range of desirable qualities that they possess point to a much broader field. From timing gears to ornaments they fit the picture. Here is an article that tells the story. It is for everybody from engineer to body designer.



PLASTICS—

By Herbert Chase, M.E.

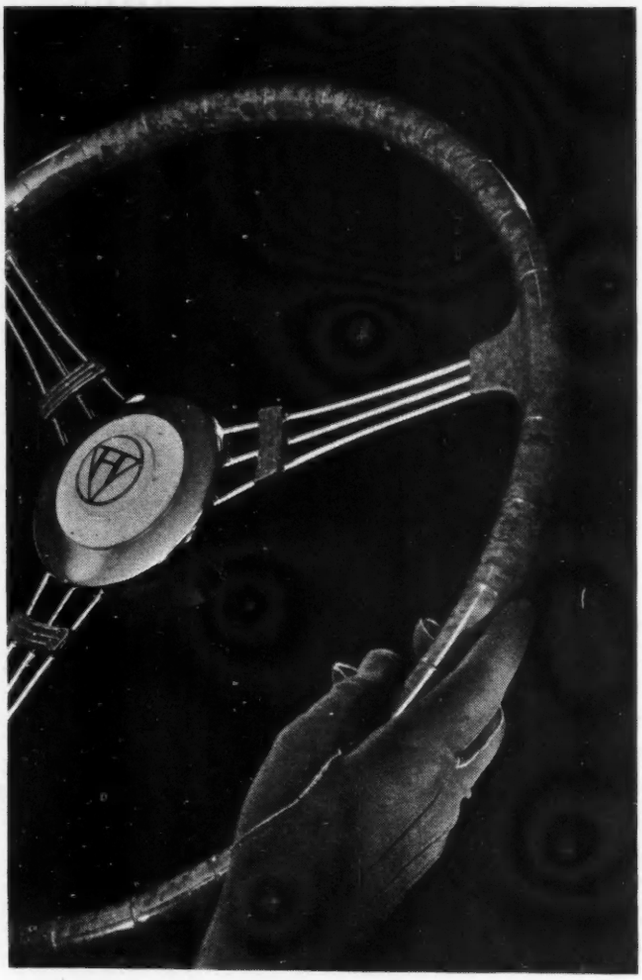
SINCE appearance has a pronounced effect upon motor-vehicle sales, anything which may add to appearance is deserving of attention by the automotive designer. Plastics fall within this class and they have in addition numerous other desirable properties such as high dielectric strength, light weight, ability to be molded either into simple or complex forms, ability to resist atmospheric deterioration, high resistance to water and to chemical reaction, availability in transparent, translucent or opaque forms and fairly high strength in relation to weight. Plastics are also relatively non-resonant, possess high wear resistance, require no applied finish, offer considerable resistance to heat, for certain purposes make a good bearing surface and are often readily combined with metals with advantage to both types of material.

Not all plastics have all of these properties. The degree to which they are possessed varies with the type and with the composition of a given type as well as with certain other factors. It is clear, however, that any group of materials having so imposing a list of advantages is quite certain to gain rapidly in automotive use.

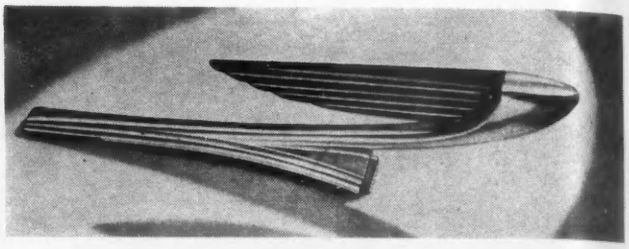
Plastics owe their name to their ability to be molded, a property which accounts for great utility in many automotive applications. It should not be forgotten, however, that many plastics are used without molding. Nearly all types can be had, like metals, in the form of sheets, rods, tubes and slabs, capable of being machined with the same or very similar tools to those used in metal working. Some forms can also be had as castings. It is not necessary, therefore, to invest in molds or to employ molding equipment to make use of plastics, although it is often highly advantageous to do so. It is well to remember, however, that about half the plastics sold are not molded (even when of a type which can be molded) and that the total sales value of plastics not molded probably exceeds that of molded forms. This does not take into consideration rubber, the most important of all plastics, reference to which (except for brief mention of a few uses of hard rubber) is made only in passing, as rubber is to be the subject of a later article.

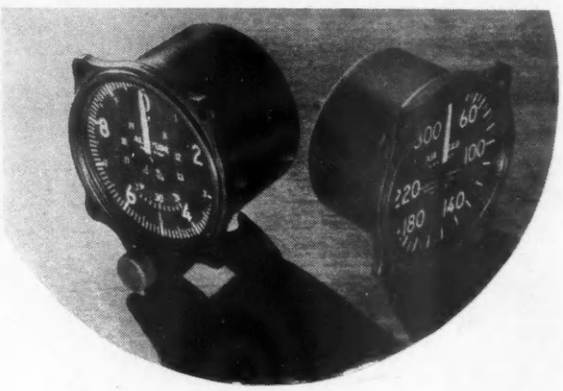
Among the most important plastics used in automotive construction are those furnished in thin sheets, employed for making laminated glass. Cellulose nitrate, once dominant in this application, has yielded ground to cellulose acetate. The latter, being less inclined to become brittle and discolor with light exposure, is now the most widely used. A new form of vinyl plastic potentially threatens cellulose acetate, being stronger and quite flexible even at moderately low temperatures, but production facilities for this type are still quite limited. Acrylic plastics have found some use in laminated glass, but only on a relatively small scale. All these materials have been, and some are still, extensively used in place of glass in aircraft, but they are too easily scratched to be suitable, except when laminated between glass, for road vehicle window lights and windshields, except for the present and quite limited use in curtains for open cars. As glass is also to be the subject of a later article, passing reference to it is made here only to point out an important automotive use of plastics sometimes overlooked.

Plastics are often divided into two general types called thermosetting and thermoplastic. Of these, the first group undergoes chemical change and sets permanently into a hard insoluble and infusible mass not (if fully cured) subject to later softening when heated. The other group, sometimes referred to as "true" plastics, are softened by heat in molding, must be cooled to become hard and can be softened again repeatedly by raising their temperature to the soften-



This steering wheel was molded from Tenite over a metal core





Transparent ruby cast phenolic parts as used in the Essex radiator ornament are striking in appearance. The same type of plastic is also employed in fender markers, cigar lighters and shifter balls

(Photo by courtesy of the American Catalin Corp.)

Aircraft instrument cases are often molded from phenolic materials because of their low cost and light weight as well as their resistance to corrosion

(Photo by courtesy of General Plastics, Inc.)

ing point, usually 160 deg. F. or above, though varying widely with the type and other conditions. There is also a third group termed "cold molded" plastics, but their only automotive use of consequence at present is in making storage battery cases, the binder being, usually, Gilsonite, pitch and drying oils or some combination of these; with asbestos filler. This form of plastic is usually molded cold and then baked. It is heavy, rather brittle and usually has a relatively dull finish, but serves its purpose, although, for battery cases, hard rubber is often preferred. There are some other cold-molded plastics, but they have little automotive interest.

Plastics in the thermosetting group are of great automotive importance. They include the phenol-formaldehyde (phenolic type), urea-formaldehyde (urea type) and phenol-furfural classes. The last named is similar to the phenol-formaldehyde in general properties but is relatively little used. Ureas are similar to phenolics in most properties but, being somewhat higher in price, are confined chiefly to use in light colors or where translucency is needed. Ureas are light in color and do not darken (as do the phenolics) with aging and light exposure. In addition, the colors are light-fast, as a rule, whereas most phenolic colors are not light-fast, although black and dark brown, the colors most used in phenolic plastics, are affected relatively little by such light exposure as is commonly encountered in service.

All thermosetting plastics are produced with synthetic resins which soften and flux when heated in molding and, as heating is continued, are cured (that is, polymerized or set) and become permanently hard. Resins used in the molding plastics act as a binder and are nearly always used with a filler, generally forming about half of the molding compound. The filler reduces cost and adds strength. The cheapest phenolics have a wood-flour filler, are inclined to be somewhat brittle but are entirely satisfactory for a large range of parts. If asbestos and/or mica or other minerals are used as fillers, heat resistance and water resistance are increased. Use of a shredded fabric as a filler greatly increases impact strength, but makes molding more difficult and requires higher pressures. Other variations improve dielectric strength and resistance to arcing.

Urea plastics, although they can use the same or similar fillers, are made in this country chiefly or wholly with a filler of alpha cellulose, such as is used in making some white papers. Since the resin is transparent and the filler translucent, the combination is translucent and this makes for greater depth of color. White and ivory moldings of thin section have a translucency equal to opal glass and are thus well suited for dome-light and similar lenses, for which they are much used. They weigh about half as much as glass, for the same section thickness and, being much less fragile, can be made in thinner sections. Other urea moldings are employed for instrument dials, horn buttons, knobs and for trim of various kinds.

Ureas swell and crack if used in continued contact with water, as do the ordinary phenolics and some other plastics. Outdoor exposures which involve occasional wetting are feasible with

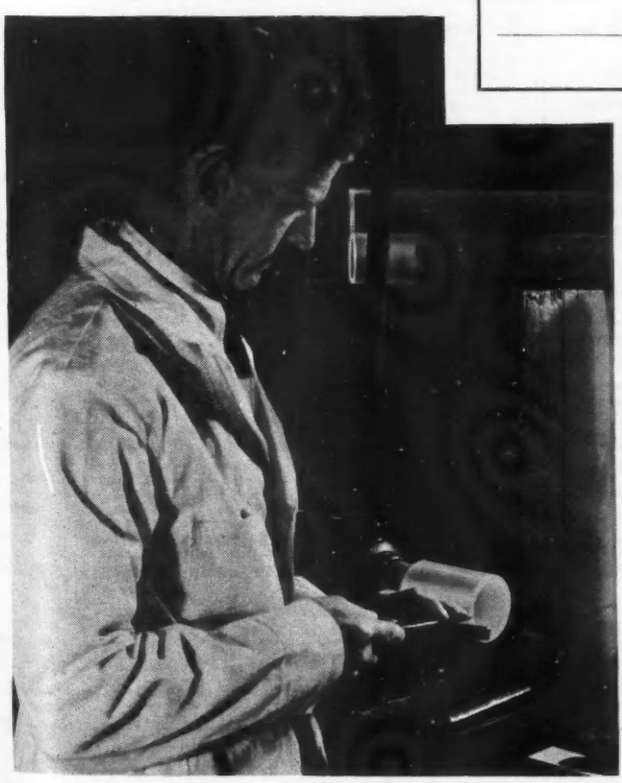
ureas and also with phenolics, although the latter, as already stated, are prone to color change. Some grades of phenolic, however, are so resistant to water that they can be and are used even for water-pump impellers (Ford 60). The phenolics are widely used also for molding parts of ignition systems and are employed also for instrument and other cases and housings, some of them for aircraft instruments in which light weight is an important factor. Many door bumper blocks are phenolic moldings, the surface material containing enough graphite to provide excellent lubricating and non-scoring properties in contact with metal—an important advantage and one suggesting other uses where good bearing properties are needed.

A highly important type of plastic for automotive as well as for other uses is the laminated form. This is made by dissolving the (uncured) resin (usually phenolic) in a solvent, impregnating paper or fabric with the solution, evaporating the solvent and then combining the sheets in almost any thickness required under heat and pressure (during which the resin is fluxed and cured) to form sheets, rods or tubes. The paper or fabric lend strength and shock resistance and provide a degree of resilience highly desirable in some cases. Blanks for timing gears can be cut from sheets made in this way or can be built up from laminated stock in what amounts to a molding operation in which macerated fabric and laminated segments are formed into individual blanks in which gear teeth are later cut. The spoked gear helps to promote silence in operation and all laminated gears operate in mesh with metal gears or pinions with remarkably little noise and relatively little wear. Timing gears of this type constitute a most important plastic application. Thousands of washers stamped from laminated sheet stock are employed for dielectric applications and some for taking light thrust loads in which a non-scoring material is required.

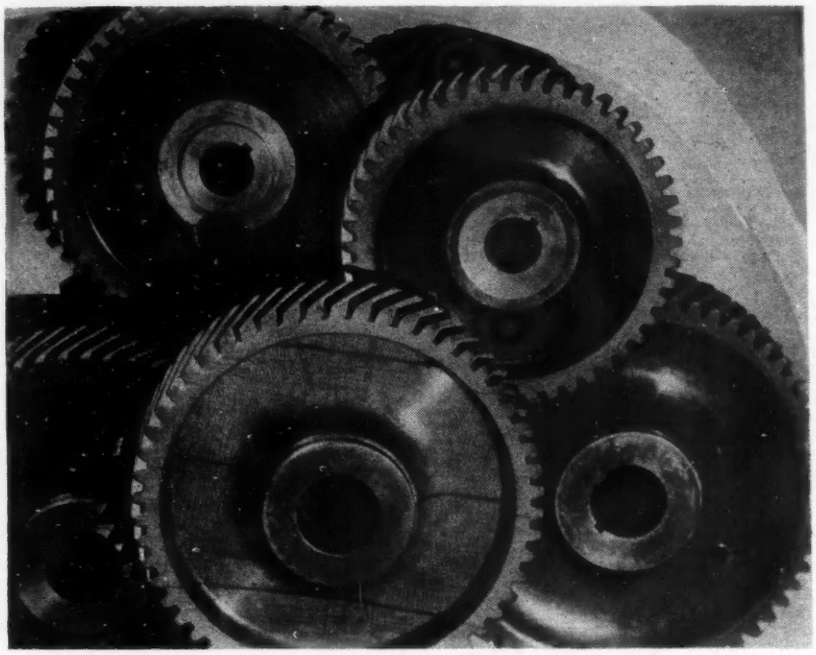
Still another use is found for laminated plastics in thin translucent sheets used for radio and other dials. Such sheets can be printed with a scale and transmits plenty of light. In common with all phenolic (and urea) materials, they are non-flammable. In some translucent sheet, phenolic resins are used and in some cases urea resins are em-

Types of Plastics and The Makers

Type of Plastic	Primary Current Automotive Applications (NOT including laminated glass)	Principal Makers of Plastic Materials Employed
Molded Phenolics (Also molded phenol-furfural in some instances)	Ignition parts such as distributors, coil cases, etc. Dovetail bumper blocks, housings and cases for instruments, defrosters, etc., knobs, trim, instrument panels, horn buttons, radio parts, ash trays, switch parts, insulating parts.	Bakelite Corp. Durite Plastics Div., Stokes & Smith General Electric Co., Plastic Div. Makalot Corp. General Plastics, Inc. Resinox Corp. The Richardson Co. Westinghouse Electric & Mfg. Co., Micarta Div.
Laminated Phenolics	Timing gears. Insulating washers, tubes, plates, etc. Thrust washers Paneling (aircraft) Pulleys (aircraft) Translucent radio dials	American Catalin Corp. Bakelite Corp. Continental Diamond Fibre Co. Durite Plastics Div., Stokes & Smith General Electric Co., Plastics Div. General Plastics, Inc. National Vulcanized Fibre Co. Resinox Corp. The Richardson Co. Synthane Corp. Westinghouse Electric & Mfg. Co., Micarta Div. Spaulding Fibre Co. Mica Insulator Co. Formica Insulation Co. Panelyte Co.
Cast Phenolics	Fender markers Radiator ornament parts Cigar lighter parts Knobs	American Catalin Corp. Bakelite Corp. du Pont Viscoloid Corp. Fiberloid Corp. Marblette Corp.
Ureas	Dome light lenses, knobs, instrument dials Horn buttons, trim parts Radio parts	Beetle Prod. Div., American Cyanamid Co. Plaskon Company, Inc.
Acrylic	Glass substitutes (aircraft)	du Pont Viscoloid Corp. Rohm & Haas Co., Inc.
Cold Molded	Battery boxes	General Electric Co., Plastics Div. The Richardson Co.
Cellulose Acetate	Knobs, steering wheels, instrument panels, trim parts, bezels, lenses, switch plates, glass substitutes (aircraft), cigar lighters, radio parts, visor brackets.	Celluloid Corp. du Pont Viscoloid Corp. Fiberloid Corp. Hercules Powder Co. Tennessee Eastman Corp. Nixon Nitration Works John W. Masury & Sons
Cellulose Nitrate	Curtain lights Instrument dials, glass substitutes (aircraft)	Celluloid Corp. du Pont Viscoloid Corp. Fiberloid Corp. Gemloid Corp. Hercules Powder Co. Nixon Nitration Works



A lathe - turning experimental operation on Lucite, the new plastic recently announced by du Pont



Timing gears in laminated phenolic materials. Similar gears but with spokes rather than solid webs are also extensively used.

(Photo by courtesy of the Bakelite Corp.)

ployed. Such sheets are usually light ivory in color but are sometimes made in tinted light colors.

The remaining form of phenolic material is the cast type. This is formed with pure liquid resin which can be made nearly water white and transparent but is usually tinted with dyes to give either transparent or translucent effects of almost any depth or a great variety of mottled effects. Opaque colors are also available. The degree of permanency of the color depends largely upon the dye, although the resin itself may discolor slightly. With light-fast dyes, the colors change little if any more under light exposure than do fabrics similarly dyed. They are, in other words, "commercially fast" and in most cases adequately light resistant even for exterior exposures, though some colors fade badly.

In making the cast phenolics, the liquid resin is poured into lead molds and then subjected to a relatively low-temperature cure for several days, the heat not being sufficient to affect the

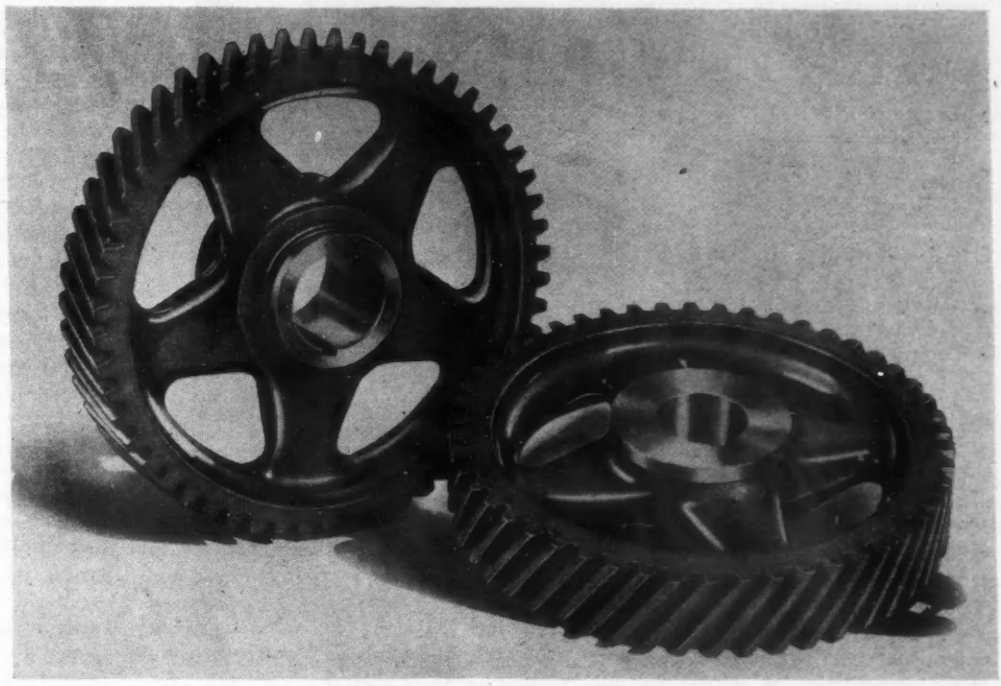
Properties of Plastic Materials Used in Automobiles

† Properties	PHENOL-FORMALDEHYDE MATERIALS						Phenol-Furfural Wood flour filled	Urea-Formaldehyde Alpha cellulose filler	Meth-Acrylic Resin
	Wood flour filled	Mineral filled	Fabric filled	Laminated		Cast type			
				Paper	Fabric				
Tensile strength, lb. per sq. in.	6,000–11,000	5,000–10,000	6,800–8,000	6,000–13,000	8,000–12,000	3,000–5,000	5,000–12,000	4,000–13,000	8,000–10,00
Compressive st'gth, lb. per sq. in.	25,000–36,000	18,000–36,000	20,000–30,000	20,000–40,000	35,000–38,000	10,000–18,000	28,000–36,000	10,000–30,000	
Impact* strength—ft. lb. per sq. in.	1.5–3.5 Izod	1.5–4.5 Izod	25–30 Izod	5–15 Izod	10–65 Izod	1–2.5	1.0–6.5	2.0–2.4	1.6–2.4 Chr. 0.8–1.0 Izod
Specific gravity	1.34–1.52	1.8–2.0	1.37–1.40	1.2–1.4	1.3–1.4	1.30–1.33	1.30–1.40	1.46–1.55	1.16–1.20
Heat resistance, deg. Fahr.	300	400–500	250–300	225–300		160	290	170	
Softening point, deg. Fahr.	chars					176–212**			130–240
Dielectric strength, volts/mil, instantaneous	300–500	250–400	300–450	500–1300	200–600	300–400	400–600	300–550	480
Hardness	34–40 Brinell	45 Brinell	40 Brinell 500 kg. load	40 Brinell 80 Scleroscope	38 Brinell 72 Scleroscope	30–70 Rockwell Brinell 60 kg. ⅛ bl.	35–40 (500 kg.)	48–50 (500 kg. 10mm) 80-90 Scler.	17–20 Brin. (500 kg. 10mm)
Burning rate	Very low	nil	almost nil	very low	very low	very low	very low	very low	slow
Effect of sunlight exposure	discolor or fade	light shades discolor	light shades discolor	lowers surface resistance, may discolor		non-fast colors fade	colors darken	slight or none	none
Clarity	opaque	opaque	opaque	opaque or translucent	opaque	transparent translucent opaque	opaque	translucent and opaque	exceptionally high
Colors	dark	dark	dark	various	dark	unlimited	dark	unlimited	unlimited
Machining properties	fair	fair	fair	fair	fair	good	fair	fair	fair
Molding properties	Excellent	good	fair				excellent	excellent	excellent
Molding temperature, deg. Fahr.	300–350	270–330	270–330	250–350	250–325		330–400	260–325	295–315
Compression molding pressures, lb. per sq. in.	2,000–4,500	2,000–6,000	3,000–8,000	1,000–3,000	1,000–2,000		1,000–3,000	2,000–5,000	1,500–5,000

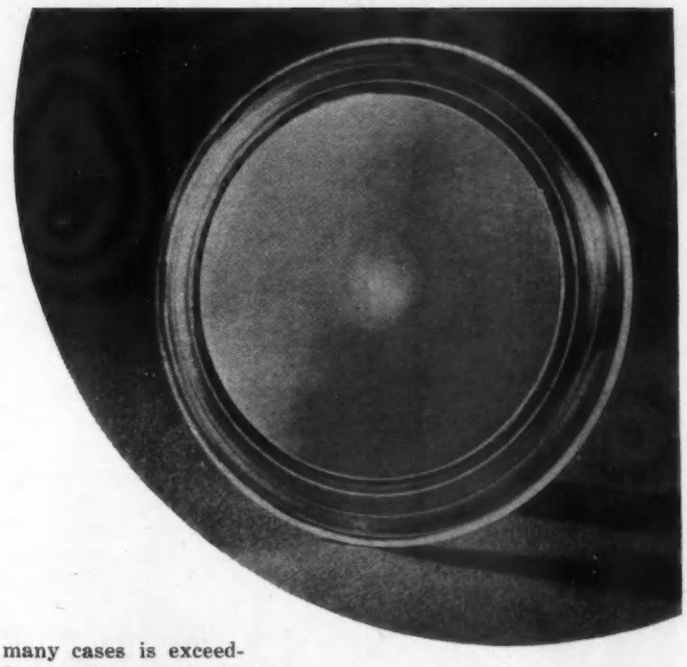
† Note: Nearly all plastics come in various grades, and molding types, in particular, are varied in composition to yield varying properties, hence the wide range in values given. In many instances, materials with certain properties outside the range given may be available for special purposes. Figures given are drawn from information furnished by different manufacturers or prepared by the Bureau of Standards and in some instances the values may not be strictly comparable because standardized test procedure is not always employed, even when a recognized standard exists.

* Impact in ft. lb. to break a ½x½ in. notched bar divided by width of specimen (½ in.) times thickness squared (½²).

** Cast phenolics not too fully cured can be softened for



Spoke Celoron gears made by the Continental-Diamond Fibre Co.



Cold Molded Asbestos filled	Cellulose	
	Acetate	Nitrate
800-2,500	2,800-6,000	7,000-10,000
3,000-4,000	4,000-15,000	
0.5-2.5 Izod	1.2-5.2 Izod	10-11.5 Izod
1.8-2.0	1.27-1.56	1.35-1.60
500		decomposes 212-300
	120-230	160-195
60	470-1,000	300-780
15-20 Rockwell B	5.9-7.5 Brinell (10 kg. 2.5 mm)	45-65 (25 kg. 2.5 mm)
nil	low	very high
	slight discoloring and embrittlement	discolors becomes brittle
opaque	transparent, transl	ucent, opaque
dark	unlimited	unlimited
poor	good	good
fair	excellent	good
room	250-400	185-248
4,000-12,000	2,000-5,000	2,000-5,000

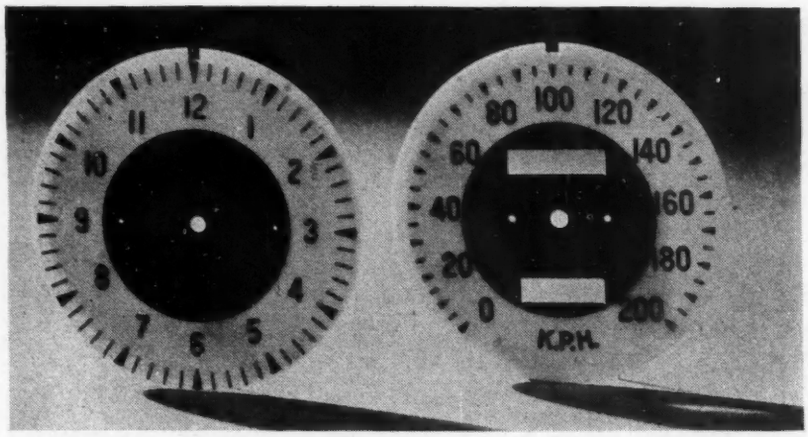
working at the temperature given, but such heating must be short and results in making the piece harder, subsequently as the material is not thermoplastic. Prolonged exposure above 160 deg. Fahr. results in color changes in some cases.

color, which in many cases is exceedingly brilliant. Most castings are in the form of sheets, rods or tubes, but castings specially shaped can be made, and thin sheets can be sliced from partly cured stock and then be fully cured. They machine and polish readily. To date, the chief automotive applications have been in knobs, heads for fender markers, cigar-lighter parts and portions of the radiator ornaments used on recent Hudson and Terraplane cars. Cast phenolics are non-flammable.

Soya plastics, so called, developed by the Ford Motor Company, and available also from at least one supplier of phenolic plastics, are really a modified form of phenolic. Soya meal, used in making them, constitutes part of the filler and at least a part of the protein in the meal is converted, in reacting with formaldehyde, into a resinous material forming part of the binder along with the phenol-formaldehyde also formed in making the batch. Properties of soya plastics are similar to the "straight" phenolics and molding is done in the same way and at the same rate.

By far the most important of the thermoplastics is the cellulose-acetate type. In appearance, it is precisely the same as cellulose-nitrate,* the oldest of

* Aside from use in curtain lights and in laminated glass, cellulose nitrate (one of the most important of all plastics) finds only minor automotive uses. Some has been used in instrument dials and in tail-light lenses. Molding can be done with sheet and bar stock, but not with powdered or granular materials either in injection or compression molding.



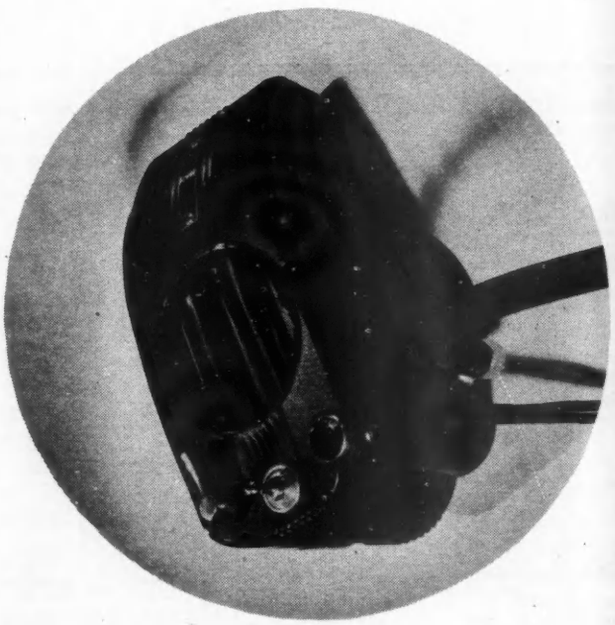
Instrument dials for Packard cars in which the translucency and light color of urea plastic in ivory accounts for its selection

(Photo by courtesy of the Plaskon Co., Inc.)

all synthetic plastics, but it is relatively slow burning, whereas the nitrate burns rapidly when ignited and requires special precautions in working and storage. Practically any coloring can be applied in making acetate and it can be had in transparent, translucent or opaque form. Molding is done at temperatures ranging from about 280 to 340 deg F., depending upon the hardness grade selected. Besides molding powders or granules, sheets, rods and tubes are also available and can be machined readily or shaped by molding.

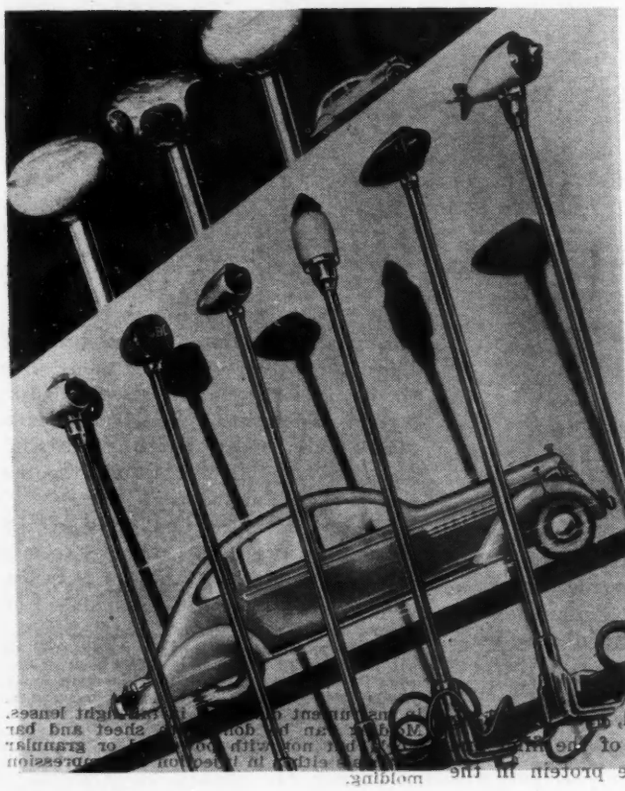
In compression molding, the acetate compound is heated and softened in the mold, just as for thermosetting materials, but it does not "cure" under heat. It remains soft until the mold is cooled, hence it must be cooled before moldings are removed, if moldings are to retain their shape. In compression molding, the mold is arranged with channels for alternate heating with steam and cooling with water. Time required for cooling and reheating the mold lengthens the cycle and tends to increase cost, but the process is entirely practical, especially in large multiple-cavity molds and even in single-cavity molds for large parts, such as steering wheels, in which the color effects and some other properties are not duplicated by other plastics at the same cost.

Of increasing importance is a relatively new form of injection molding similar in some respects to die casting except that the temperatures involved are lower and the pressures required are higher because of the high viscosity of the plastic. The latter is heated outside the mold in an injection cylinder and is then forced into a cold mold under heavy pressure (usually about 20,000 lb. per sq. in.) by a hyraulic plunger. As the mold is cold, the injected plastic hardens quickly and the mold can be opened almost immediately after filling and the molding or moldings ejected. At present, commercial machines available handle a maximum of about 1½ to 2 oz. per shot, hence the size of moldings producible is rather small and the automotive products turned out to date are confined chiefly to knobs and other small parts, primarily for decorative purposes. As several cavities for such pieces are usually feasible and speeds up to or about six "shots" (mold fillings) a minute maximum can be made, the production rate is quite high. If the full capacity of the machine is used at each shot, however, it is likely to be limited to about three shots a minute, as the rate at which the plastic can be heated is limited and it cannot be held

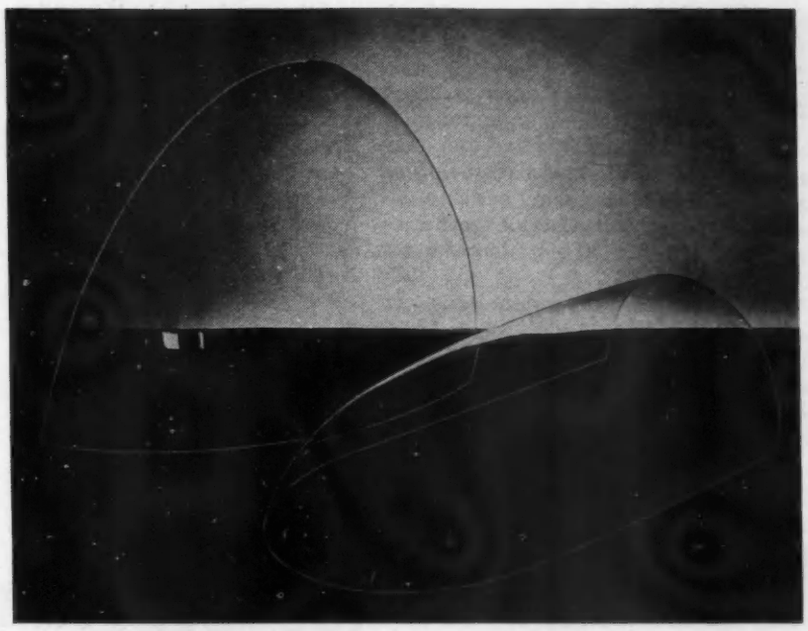


Windshield defroster housing, typical of phenolic molded applications in which appearance and freedom from need of applied finish are strong reason for the selection of this material.

(Photo by courtesy of the Bakelite Corp.)



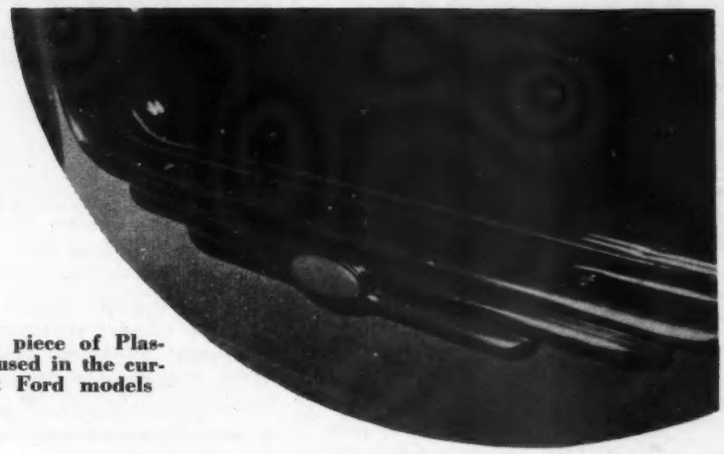
Various types of fender guides and gear shift lever knobs made in various colors of Catalin.



Here is an interesting picture of samples of Plexiglas, which has curved in three dimensions. This is the product of Rohm & Haas Co., Inc.

long at the injection temperature without deterioration. This applies to cellulose acetate plastics which, to date, are the only ones used extensively for injection molding of automotive parts. Although limited quantities of other plastics suitable for injection molding are available, they are at present more expensive than cellulose acetate which ranges from about 30 cents a pound for black opaque up to 60 cents a pound or more for the fancy light colors and mottled effects, usually demanded for automotive uses, which are largely decorative.

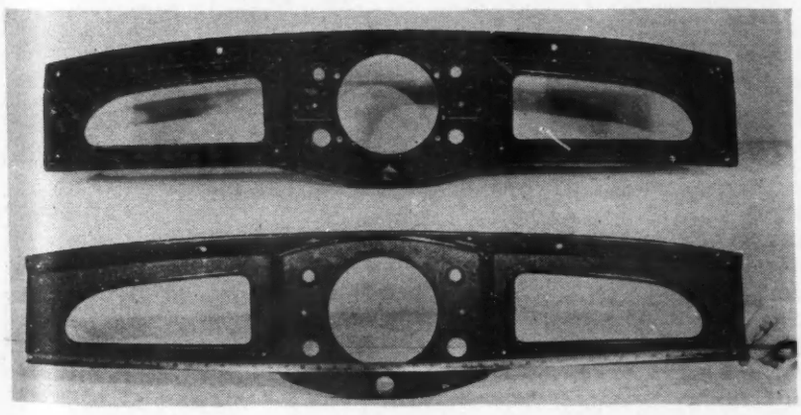
Injection molding, though extensively used in production, is still in the development stage. It is being tried experimentally for much larger parts, such as steering wheels (now produced by compression molding) and may yet displace compression molding of thermoplastics. Theoretically, thermosetting plastics can be injection molded also, but the problems involved are different and difficult of solution and the time needed for cure tends to slow production rates. A form of injection molding, sometimes termed "transfer" molding is now done to a small extent, but its advantages are somewhat limited and the materials employed do not match the acetates in beauty. Some work has been done in covering metal parts, such as die-cast hardware, with a thin coating of acetate by injection molding, but costs are still much higher than for plated parts of the same general design. Possibilities in this direction are being further investigated and are not without promise, as the colorations possible are not duplicated otherwise with metal-cored pieces. The metal core adds, of course, to the strength of the finished part.



Inlay piece of Plaskon used in the current Ford models

Ford is experimenting with another thermoplastic, benzyl cellulose, which is considered promising in some respects. It presumably can be molded either by compression or injection methods and has been extruded into straight moldings which can be formed subsequently into window frames and the like if desired—another type of working in plastics which holds possibilities.

Among the other thermoplastics available, as yet in rather limited quantities and all capable of injection molding, are the vinyl, acrylic, ethyl cellulose and styrol types. All these have certain desirable properties of their own, but as yet they are more costly than cellulose acetate and, except for rather special purposes, offer little for automotive uses not available in acetates. This condition may change as production facilities are increased or other factors enter the picture, or some less expensive type of plastic capable of displacing existing types may yet be developed. Acrylic plastics have remarkable clarity



Front and rear views of instrument boards molded in one piece from phenolic material for a German car
(Photo by courtesy of the Bakelite Corp.)

and are reported to be very easy to work by injection molding. Coloration can be very beautiful and if their cost is greatly reduced in the hands of manufacturers with large resources now beginning their production, large automotive uses may yet be realized. Somewhat the same may be said of the vinyl plastics, already made in considerable quantities though having found only limited automotive use.

Any comprehensive consideration of plastics ought to include reference to those artificial rubbers or rubber substitutes sometimes called neoprenes, although they are, perhaps, more properly considered along with rubber which they resemble in certain properties. They can be molded and worked otherwise much like rubber, but are not affected by contact with gasoline or lubricating oil as rubber is. This fact accounts for a few automotive uses where rubber would not meet requirements. Another favorable factor is freedom from deterioration by ozone and by "corona effects" injurious to natural rubber.

An early and possibly very important use of plastics may come in the form of interior trim for passenger-car bodies molded for door panels, instrument panels and the like. Low cost and the assurance of adequate production facilities are important requirements to be

(Turn to page 738, please)

Automotive *Materials* NEW DEVELOPMENTS

Fire Hazard Minimized By Non-Sparking Tools Made of Aluminum Bronze or Beryllium-Copper

In doing mechanical work in localities where there is considerable fire hazard by reason of the possible presence of inflammable gases, tools which are likely to produce sparks must not be used. In such localities it has come to be the practice to use non-sparking tools made either of aluminum bronze or beryllium-copper.

With aluminum bronze it is possible to obtain Brinell hardnesses ranging between 100 and 350 without heat treatment. The hardest grades can be used for cutting tools, in spite of the fact that they are somewhat brittle, and the softer grades are used for operations where considerable shock must be withstood by the cutting material.

Tools of aluminum bronze are said to cost substantially twice as much as steel tools but less than half as much as tools made of beryllium-copper.

Strength Tests On Welded Chromium-Molybdenum Steel Tubing and Sheet

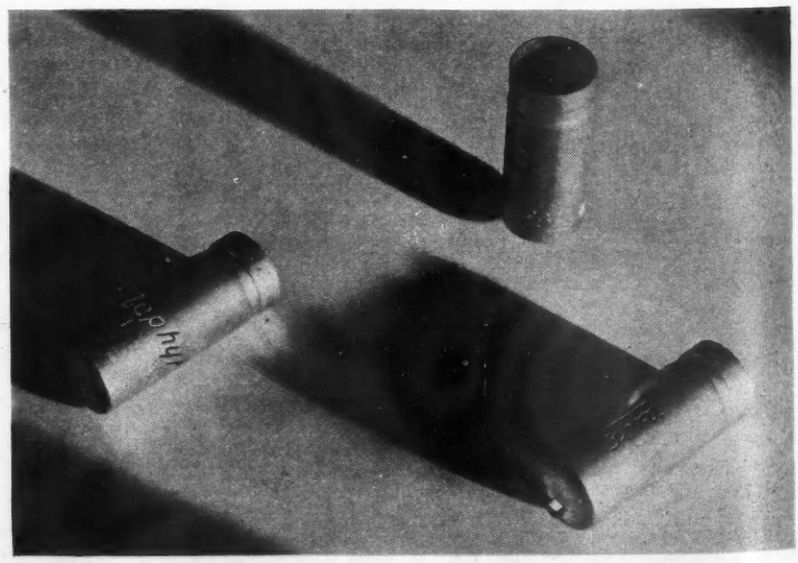
Results of strength tests made on welded joints of chromium-molybdenum steel tubing and sheet are reported in the Technical Bulletin of the National Bureau of Standards for May, 1937. The three kinds of oxy-acetylene welds investigated were: Welds in which low-carbon steel welding rod and a neutral flame were used; similar welds made with chromium-molybdenum steel welding rod; and the recently developed carburizing-flux process utilizing an excess acetylene flame.

In welding joints in 1½-in. O.D. tubing with wall thickness of 0.020 in., only the carburizing flux process produced unions free from cracks. Butt joints of heavier chromium-molybdenum tubing and sheet formed by the three methods had approximately equal strengths in the as-welded condition. When heat-treated, joints made by the carburizing-flux process and those welded with chromium-molybdenum rod were stronger than joints made by the low-carbon welding rod.

Strength of tubular joints loaded under tensile, compressive, and bending stresses was determined for the as-welded and the heat-treated condition. It was found that gusset plates inserted in slots in the tubing appreciably increased strength of some joints.

Zinc Condenser Cases Produced By Impact Extrusion Process

The General Extrusion Corp. is now producing zinc condenser cases, or "cans," by the impact extrusion process. The latter consists of striking a slug of zinc in a die with an opening equal to the outside diameter of the



can. As a result of impact, metal fills the die cavity and is forced or extruded around the narrow annulus between die and punch to form the side wall of the can. In the same blow, the bottom of the can and any lugs required are formed.

Zinc cans for Ford ignition condensers, some of which are shown in the accompanying illustration, are ¾ in. in diameter by 1 15/16 in. long and have a wall thickness of 0.015 in. On the bottom there is an eccentric solid integral lug of ⅛ in. square section and 5/64 in. high. A supporting bracket is slipped over this, the lug struck, and the bracket is riveted to the can. A bead is rolled with top edge 13/64 in. below the top edge of the can. After the condenser is inserted and a cover placed against the bead, the top is spun over, sealing the can. These latter operations are performed by the condenser manufacturer. The lead for the condenser is brought out through a 5/64-in. hole punched in the bottom of the can and then soldered to the can.

New Literature Offered on Several Materials

Tables listing results of tests of four major physical properties of zinc base die cast alloy No. 6 (nominal composition: aluminum, 4.10 per cent; copper, 1.25 per cent: balance 99.99 per cent plus zinc) are presented in Metalgram No. 21, which was recently compiled and published by Apex Smelting Co., Chicago.*

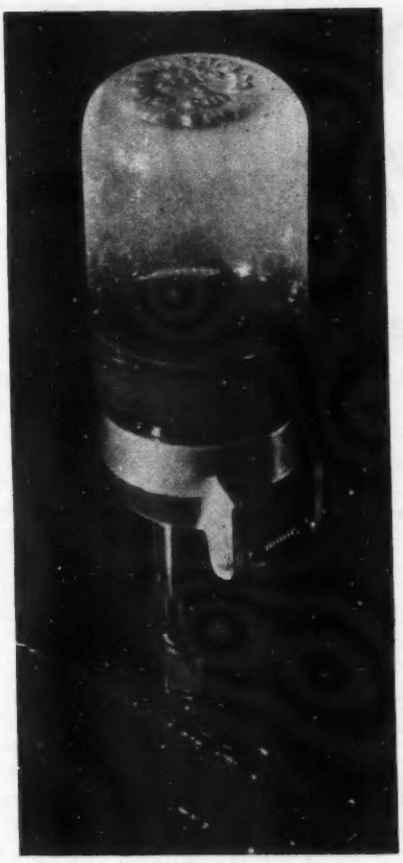
A recent development in upholstery material for automotive applications is described in a pamphlet issued by the B. F. Goodrich Co., Akron. The new product, called Nukraft, is made of sterilized hair, dipped in latex, and formed into loops.*

Detailed information on the utility of graphite surfaces is contained in the latest technical bulletin issued by Acheson Colloids Corp., Port Huron, Mich. Various properties imparted to surfaces of metals, glass, and miscellaneous substances by application of colloidal graphite films are fully described.*

*Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address, Chestnut and 56th Sts., Philadelphia.

Data On Thermal Expansion Of Cemented Tungsten Carbide

Data on linear thermal expansion of tungsten carbide-cobalt mixtures containing about 6 to 13 per cent cobalt is presented in a report by Peter Hidnert which was recently brought out in pamphlet form by the National Bureau of Standards. These products, called "cemented tungsten carbide" or Carboloy in the United States and Widia in Germany, are used in tools for cutting a wide range of materials.



New Type Oil Cup—This transparent, unbreakable oil cup is one of many industrial products in which a plastic has replaced glass. Tenite, which successfully met the requirements of the Gits Corp. in this use, is a thermoplastic molding composition manufactured by the Tennessee Eastman Corp.

In investigating characteristics of the mixtures, observations were made at various temperatures between 20 deg. and 40 deg. C. The following conclusions were drawn from the results:

1. The average coefficient of expansion of cemented tungsten carbide containing 5.9 per cent cobalt increases from 4.4 x 10^{-6} for the range between 20 and 60 deg. C. to 5.9 x 10^{-6} for the range between 300 and 400 deg. C.

2. The average coefficients of expansion of samples of cemented tungsten carbide containing from 12.9 to 13.2 per cent cobalt, increase from 5.0 x 10^{-6} for the range between 20 and 60 deg. C. to 6.7 x 10^{-6} for the range between 300 and 400 deg. C.

3. For the range from 20 to 400 deg. C., the average coefficients of expansion of samples of cemented tungsten carbide containing about 13 per cent cobalt are 15 per cent greated than the coefficient of expansion of the cemented tungsten carbide containing about 6 per cent cobalt.

4. Rates of expansion of samples of cemented tungsten carbide increase linearly with temperature. The rates of expansion of the cemented tungsten carbide containing 13.0 per cent cobalt are greater than rates for the carbide containing 5.9 per cent cobalt. The rates of expansion of samples of cemented tungsten carbide are greater than the rates of expansion of tungsten, and considerably less than the rates of expansion of cobalt.

X-Ray Method For Rating Lubricants In Terms of Protection Against Surface Wear

Copies have been received from the Continental Oil Co., New York, of a pamphlet on Modern Lubricants — X-Diffration Studies of Molecular Structures and Orientations, Including an X-Ray Method of Rating Lubricants in Terms of Protection Against Surface Wear. The three articles reprinted in the pamphlet (from *Industrial and Engineering Chemistry*) are by George L. Clark and Robert H. Sterrett of the University of Illinois and Bert H. Lincoln of the Continental Oil Co.

Tests were made of various lubricants in the Almen machine. X-ray diffration patterns of the brass pins used in this machine were taken at the beginning of a test and after the machine had been run with a given lubricant on the pins under constant load for a certain length of time. The amount of "fibering" of the surfaces of the brass pins was determined by microphotometer analysis.

It was shown that certain additional agents which tend to increase film strength also decrease abrasive wear between rubbing surface, as compared with straight mineral oils.

Recent Rayon Developments Include Improved Tensile Strength

A number of improvements in rayon have been made recently, and the principal new developments include improved tensile strength, pigmentation, and rayon staple. These latter were emphasized by Dr. Charles S. Venable, Viscose Co., in a summary reported in the *Industrial Bulletin*.

Increase in tensile strength has been achieved with better understanding of

(Turn to page 739, please)

Just Among Ourselves

An Embarrassing Wealth of Material

THERE are so many actual and so many possible uses for plastic materials in the automotive industries that we found ourselves with an almost embarrassing wealth of data when it came time to put together the article on plastics which begins on page 722 of this issue. Because of this, we had to cut down the scope of the article somewhat, leaving out, for the moment, such important items as the plastic bonds used in safety glass, molded hard rubbers used for steering wheels and other applications, and some of the newer possibilities of plastics which are now in the preliminary stages.

In pointing this out, it is possible to state that the omissions will be cared for in subsequent articles in the series on automotive materials. One whole article will be devoted to glass and another to the applications of rubber (excepting tires) in the motor vehicle.

We are extremely gratified by readers' response to the series of articles on materials, which appears in the third issue of each month, and which will be continued indefinitely on that basis. On the whole, it is necessary to work far in advance on the preparation of data for inclusion in the series. With this in mind, subjects for featured articles in the series have been selected for publication about eight months in advance.

But that doesn't mean that the selection of subjects is a closed question. Comments and suggestions from readers concerning any aspect of the materials' series will be welcomed and used where it is possible.

Just A Foster Father—

THE aftermath of the Packard labor election brings out an interesting point which has been suspected in connection with some previous labor matters. Packard workers voted overwhelmingly in favor of the United Automobile Workers to represent them in bargaining with management.

So the UAW proceeded to negotiate an agreement with Packard management. When it came to ratification of the agreement by workers, many of them seemed to think they had been "sold down the river" by the union.

Point is this. The CIO unions, on the whole, seem more concerned with the establishment of their own power, both among the workers, and against management, than they do with the advancement of the workers' cause.

We believe Packard is one instance (and there are others) in which management has had the interest of labor closer to heart and has done more to improve security and working conditions than the unions, with all their ballyhoo have effected in twice the time.

Importance Recognized

THE National Highway Users Conference has accomplished an important task in bringing up to date its brochure on the "Economic and Social Values of the Motor Vehicle." First made in 1934 the study was titled "Economic Contributions of Highway Transportation," and was followed later by a second study on the "Economic Contributions of the Motor Vehicle."

The fact cannot be too often emphasized that "highway transportation provides jobs for over 10 per cent of all the gainfully employed workers in the United States, is a first rank consumer of many of the basic raw materials and manufactured products produced by the nation and, in addition, makes contributions to the economic well being of the country, which, though their importance is generally recognized, cannot be definitely evaluated in dollars and cents."

All such matters which can be appraised in dollars and cents are systematically presented in the brochure. In addition, there is an excellent analysis of the intangibles presented in such a way that even a state legislator might be able to understand it. We hope they do.—H. H.

Wright Cyclone Aircraft Engine

This is a nine-cylinder radial air-cooled engine of 6⅛-in. bore by 6⅞-in. stroke. The displacement is 1823 cu. in. and the compression ratio 6.45 : 1. The engine is equipped with a centrifugal supercharger which is driven at seven times crankshaft speed. It is furnished as either a gear-drive or a direct-drive unit, the reduction ratio in the former case being 16:11.

The maximum rating of the Cyclone for take off is 1000 hp. at 2200 r.p.m., with a manifold pressure equal to 40 in. of mercury. The maximum for protracted periods is 820
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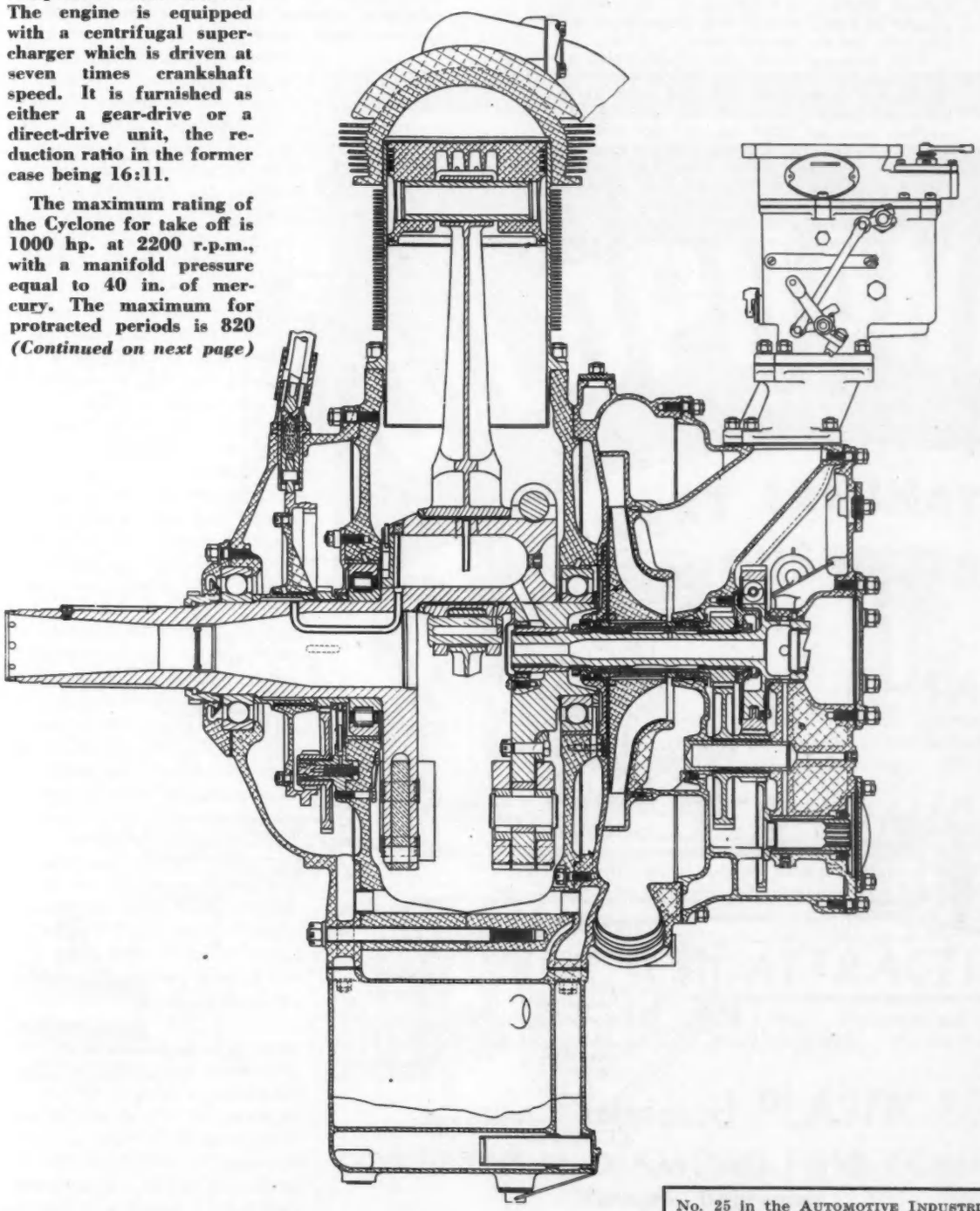


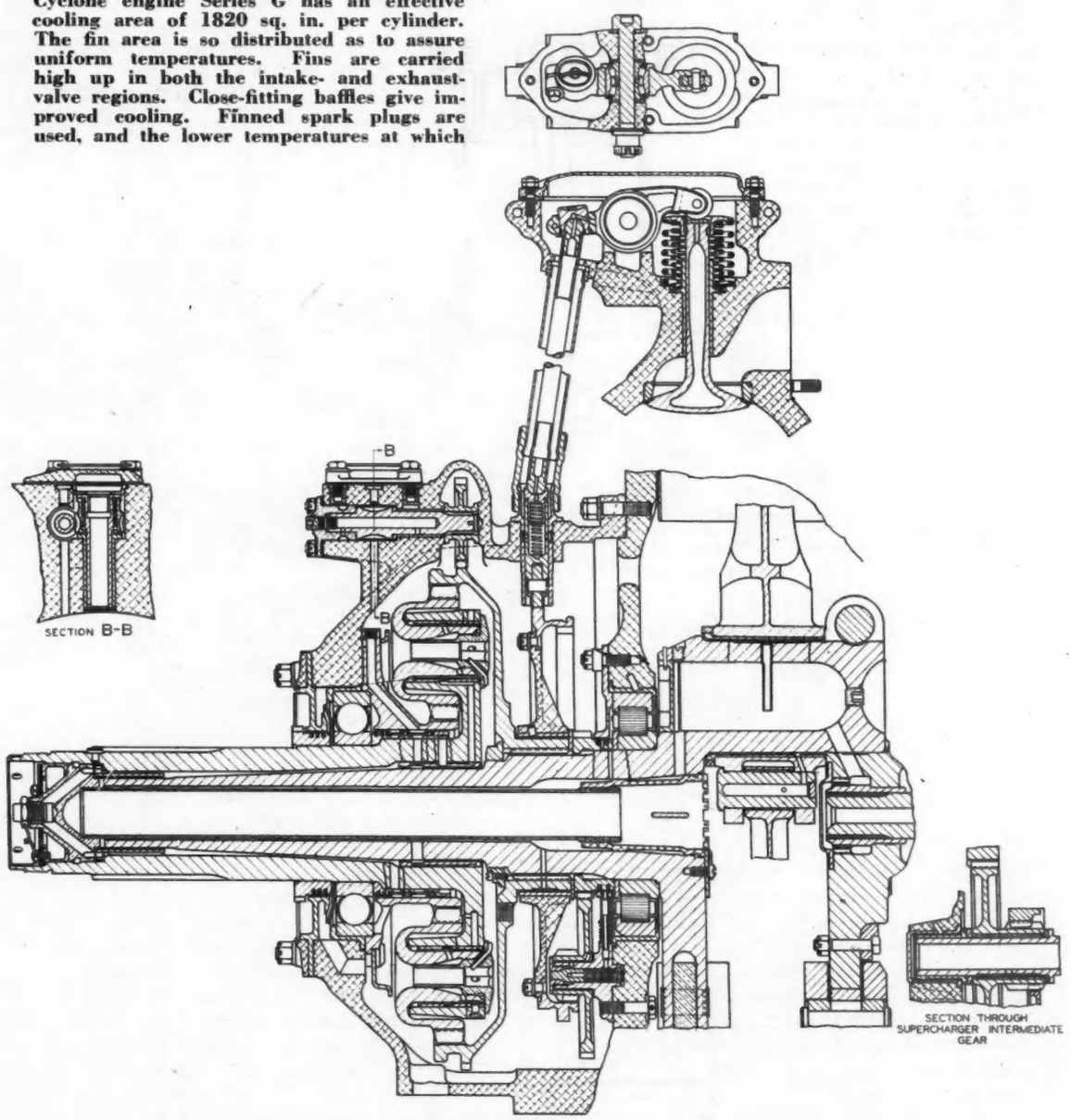
No. 25 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

Wright Cyclone Aircraft Engine

(Continued from preceding page)

hp. at 2100 r.p.m. at sea level and 850 hp. at 2100 r.p.m. at 5800 ft. altitude, both with a manifold pressure of 34½ in. of mercury. The cruising limit is 600 hp. at 1900 r.p.m. and the recommended cruising output, 500 hp. at 1850 r.p.m. The total dry weight is 1068 lb. for the direct-drive and 1163 lb. for the geared type.

With increase in the size of air-cooled aircraft engines the cooling problem becomes constantly more difficult. The new Wright Cyclone engine Series G has an effective cooling area of 1820 sq. in. per cylinder. The fin area is so distributed as to assure uniform temperatures. Fins are carried high up in both the intake- and exhaust-valve regions. Close-fitting baffles give improved cooling. Finned spark plugs are used, and the lower temperatures at which the spark plugs operate are said to reduce trouble from lead deposition. Valves, springs, and rocker arms are enclosed in valve boxes cast with the cylinder head. The induction system has been so designed as to decrease the resistance to flow and the temperature of the incoming gas. Forged nitralloy cylinder barrels are shrunk into cast-aluminum heads.



Effects of Service on Crankcase Oils

CHANGES in engine-lubrication practice and in the views of the industry regarding the effect on lubricating qualities of certain changes in oil characteristics are discussed in Bulletin No. 28 of the Virginia Polytechnic Institute (Blacksburg, Va.), "The Effects of Service on Automobile Crankcase Oils," by James I. Clower, associate professor of machine design, and N. W. Conner, assistant professor of applied mechanics.

The authors point out that today very light oils are being recommended by the car manufacturers, oils that would have been considered ruinous ten years ago, even though the service conditions were not nearly as severe then as they are now. Not many years ago dilution was given as the main reason why crankcase oil must be renewed at comparatively short intervals. That dilution cannot be such a serious factor, the authors argue, is shown by the fact that two-stroke marine engines for years have been satisfactorily lubricated by merely adding one pint of lubricating oil to five gallons of fuel and feeding the mixture through the carburetor.

The Bulletin contains a report on tests made on oil samples taken from the crankcases of a Chevrolet and a Pontiac engine at certain mileage intervals. Film breakdown tests were made by means of an Almen e.p. lubricant testing machine. The ash content was obtained by burning the carbon residue to a constant weight. The iron content was determined from the ash by a method suggested by the National Bureau of Standards. The hemacytometer count was made by means of a Levy-Hausser hemacytometer with double Neubauer ruling, and the surface tension was determined on a calibrated Anco-Du Nony surface tensiometer at 76 deg. F. Wear tests were made on a specially-built machine with ten compartments, each containing a journal of ¼-in. drill rod and a split bearing. All other tests were made in accordance with the latest A.S.T M. standard methods. The results are given in tables and in the form of curves showing the variations of the different properties with mileage.

A review of published reports leads the authors to the conclusion that changes in the characteristics of crankcase oils in service depend far more on the design of the engine, its mechanical conditions, and its manner of operation than on the properties of the new oils as determined by the present laboratory tests. They feel that the importance of the properties of new oils, as measured by laboratory tests, has been overemphasized, because in service the oils retain their original properties for only a short time. The major problem, they conclude, is not one of selection, but rather that of maintaining the oil in the desired condition.

Crank Press

New Cleveland Machine Has Hydraulic Clutch

A straight sided double crank press, arranged with twin drive to the crankshaft through herringbone gears which run in oil, has been brought out by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. Air counterbalance is provided for the slide which is power adjusted by individual motor.

The press has an electrically controlled hydraulic clutch with a four-station selector for momentary, long, continuous and inching operations. As a safety precaution, the brake is spring loaded so that, in the event of failure in the line, the clutch is immediately disengaged and the brake applied to stop the press. The machine can be furnished in a number of sizes and equipped with a style of clutch to suit individual requirements.

CONTINENTAL-DIAMOND PLASTICS

DILOPHANE

A TRANSLUCENT LAMINATED SYNTHETIC RESINOUS MATERIAL

SAFE

Will not shatter. Is non-inflammable. Provides almost perfect light diffusion.

ECONOMICAL

Easily fabricated standard size sheets to 1/32" thick. No losses due to breakage, warpage or fading. Readily printed.

ATTRACTIVE

Has dull or glossy finish. In all colors. Provides soft light diffusion. Special exclusive colors available. Prints beautifully.

a new Laminated PLASTIC by

CONTINENTAL-DIAMOND FIBRE COMPANY

Newark, Delaware

Represented in Canada by DIAMOND STATE FIBRE COMPANY of CANADA, LTD. Toronto

The roof and side walls of the new De Soto press plant are 52 per cent glass

Production Lines

Road Safety

J. H. Hunt's paper on safety recalled to our mind the fact that there is an industry committee working diligently to improve auto headlighting. Out of this committee may come contributions of dramatic value, judging by some things we have heard. However, the problems of safe night driving still centers upon better road lighting not by the headlamp but by an adequate highway lighting system. Much is known about the matter today and any highway can be fitted with the proper lighting system rather economically. Those who are studying highway safety could profit by the recent literature on this subject.

About Machinery

We heard the talk by Dr. James S. Thomas, president of Chrysler Institute of Engineering, entitled, "What Machinery Has Done to Mankind." Apart from a virile and inimitable delivery, Dr. Thomas has something unique on the ball—namely a command of all the figures and statistics and historical background on the industrial struggle. Armed with the facts, it's not so difficult to debate issues with the intelligentsia.

Management Trends

A discussion of management trends was very ably presented to the NMTBA convention last week by C. S. Craigmile, works manager, The Belden Co. According to the speaker, management must take cognizance of two broad fields —politics and labor relations—which crowd all other considerations at the present time. Industry is asked to take a more interested attitude in politics, to study issues, to assist legislators and inform them concerning business problems. Management's approach to labor relations needs no further comment except to note that this has become a major activity in manufacturing organization.

Remote Control

Some time back we discussed a number of remote transmission shifting devices using vacuum power. It was our privilege to drive a car at White Sulphur Springs equipped with an entirely novel remote shifting arrangement. The principal feature of the device is a combination of mechanical hook-up and vacuum assist which results in a normal and positive "feel" of the shifting operation. It is whispered that this device may be found on several 1938 cars, developing the sales advantage of a clean front seat compartment with room for three adult passengers.

Fuel and Lubes

Listening to much discussion, we were impressed with the definite need for the standardization of the so-called low grade fuels for the gamut of tractor applications. One suggestion was to standardize at least two significant characteristics—octane number and end point and its proponent recommended an octane number of 40, end point of 526 deg. Fahr. Standardization is the objective sought in many fields and is needed just as badly in the field of high speed diesel fuels. An excellent approach has been made in recent months which should be productive of good results not only for the diesel operator but for the oil industry.

On Depreciation

Speaking at the recent NMTBA convention, J. K. Mathieson made the point that for gaging machinery depreciation it would be far better to use a geometric life line than the straight line which is usually applied for its simplicity. In any event, regardless of the system, a definite and purposeful depreciation policy is imperative in these times because modernization is so essential if the price level is to be maintained. Among the significant statistics quoted by the speaker, we made note of the following two—that industry paid $3 billion in tax returns on the depreciation account last year; that industry today has an investment of $8,000 for every laborer in its employ.

Urges Census

At the annual meeting of the National Machine Tool Builders Association held last week, Franklyn Hobbs, Chicago economist, made a plea to industry to support a federal census of unemployment. According to Mr. Hobbs, all unemployment figures currently available are inaccurate. This shortcoming is attributed to figures coming from all of the usually authoritative sources. The AFL has stated recently that unemployed total 10,000,000 whereas, according to Mr. Hobbs, this country has never employed 10,000,000 people. An accurate census would be a boon to industry as it would give an accurate picture of the current situation from an economic point of view.

Well Placed

It was rather exciting to get a private view of a newly developed "barrel" type engine that really works. The engine is in the form of a small diameter cylinder and is said to take up less space and to weigh less than the conventional in-line or V-type powerplant. What intrigues us is the fact that this type of powerplant permits the designer to place the drive anywhere he pleases, without the usual complications.—J. G.

From the SAE Summer Meeting Come More—

Reflections of Automotive Progress

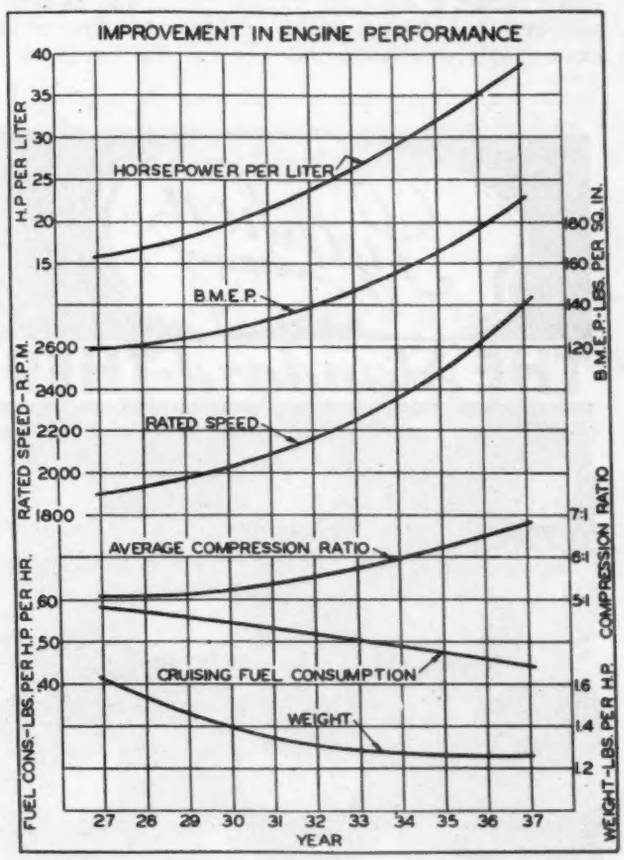
Trend in Air Engines Toward More Power and Economy

IN a paper on Powerplant Trends, George J. Mead, vice-president and chief engineer of United Aircraft Corporation, said the general trend continues steadily toward ever increasing outputs per liter, with the consequent effect of improving the take-off powers and reducing the engine size in the geometric sense. There is reason to believe that the rate of progress of the past decade can be maintained, providing the chemist, the metallurgist, and the fuel technician can keep pace with the engine manufacturer's needs.

The development of the present standard types definitely tends toward smaller cylinders for the higher outputs. This, combined with the general acceptance of the two-row type for the higher powers, has effected a decided reduction in frontal area per horsepower. From the standpoint of performance, take-off powers of 1500 to 1800 hp. seem feasible in the period immediately ahead. The ever-increasing importance of operating costs has concentrated attention on this most vital performance characteristic. As a result, great strides have been made in reducing the specific fuel consumption, and there is evidence that service consumption of 0.40 lb./bhp-hr. may be achieved within the next few years.

The evident future needs for engines of from 2000 to 3000 hp. has focused attention on other types in which additional displacement may be provided through the employment of a greater number of cylinders. Two new engine types may result, namely, the cylindrical or multi-row radial and the rectangular or flat multi-bank in-line. The form drag of these types need be no greater than for present-day powerplants, despite their decidedly greater output.

Continued improvement in engine cooling has reduced the drag of both the air- and liquid-cooled systems, and there appear to be still further opportunities of betterment. The combined reductions in powerplant drag may well result in cutting the fuel bill by as much as 10 per cent, which, combined with a possible further improvement in specific consumption, gives hope of a net saving of 15 to 20 per cent.



Graph showing the advance made in aircraft engines

There is every reason to believe that our future engine, as well as airplane development, must continue to be a steady step-by-step process, keeping pace with our knowledge, rather than a sudden advance in much larger equipment. As in the past, each gain must be consolidated by thorough and painstaking tests before further progress is feasible both from an economic and an engineering standpoint. The problems confronting the designer are more complex than ever before and require both greater time and greater expense for their solutions. Fortunately, the aviation industry has passed through its pioneering days and is now equipped with personnel and experience to deal effectively with these problems.

The accompanying graph, taken from Mr. Mead's paper, pictures the advance in engine design during the past decade.

Characteristics of Spark Discharge in Automotive Systems

THE principal characteristics of a spark discharge are its voltage and current as functions of time. When these have been determined, such other values as the crest voltage, crest current, frequency, decrement, and energy may be deduced. The most suitable instrument for the determination of voltage and current curves of the discharge is the cathode-ray oscillograph. In making the measurements it is necessary to introduce apparatus into the discharge circuit which unavoidably changes its resistance, inductance and capacitance. Therefore, in selecting the apparatus, care must be taken that either the nature of the circuit is not seriously affected or that corrections can be made for the change in the character of the discharge. *(Turn to page 743, please)*

PLASTICS

in Automotive Production

(Continued from page 730)

met. Some authorities see a possible solution in certain types of paper impregnated with phenolic resins and then molded to required size and shape, possibly even with thin fabric or thin wood veneer facing, if these are wanted. A somewhat uncertain factor is an adequate supply of phenol at low cost for making resins in the very large quantities that might be required. Ureas are potentially available in large quantities but again the question of price needs consideration.

The covering of steel panels with a thin layer of plastic strongly bonded to the metal is getting attention, but whether the cost can be brought within bounds such as to be considered for automotive use is a question still to be answered. It is worth remembering that modern automotive finishes for steel have a high content of resins the same as or similar to those used in plastics and giving the finishes similar properties. In other words, roughly speaking, the modern finish is a (modified) plastic readily applied over irregularly formed surfaces, and there is grave doubt whether a plastic coating applied by other means can accomplish a similar result at comparable cost. The automotive body builder is set up for steel fabrication and will be slow to consider a radical change in his methods. For interior panels, now made from composition pressed board covered with rather expensive fabric, the situation is somewhat different and plastics appear to have a better chance, always providing that costs can be brought within required limits.

Talk of plastic substitutes for glass is alluring. Such a substitution is possible, even today and, as already pointed out, plastics in place of glass are used in aircraft and to a very limited extent in road vehicles. The chief difficulties are those of cost and of maintaining satisfactory clarity. As compared to glass, all plastics are relatively soft and easily scratched. When scratched they lose clarity. In some cases the scratches can be removed, but whether the frequent polishing likely to be required is feasible is open to grave doubt. Ways of making an adequately hard plastic or of giving existing types a hard enough surface may yet be found. Laminated glass has been greatly improved by the use of new plastics and appears still to be the best compromise.

Pages might be written about other future possibilities of plastics. Some of these possibilities are very real and it is safe to predict that the use of plastics in automotive applications is almost sure to increase as it has in other fields.

Phenolic Molding Material With High Impact Strength

Phenolic molding material, claimed to have five times greater impact strength than standard molding products, has been announced by General Plastics, Inc., North Tonawanda, N. Y. Known as Durez 1590, the material has an impact strength designation of 0.7 (A.S.T.M.).

The manufacturer states that the plastic preforms and molds easily, has a relatively low bulk factor and, in molded form, has a somewhat rippled surface.

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New Developments in Automotive Materials

(Continued from page 731)

the arrangement of the chains of cellulose molecules. These chains are drawn into stronger patterns by stretch spinning. Through augmented knowledge of surface shrinkage phenomena, surface structure is produced better suited to various uses. While ordinary rayon is satisfactorily strong for general textile purposes, it is apparently not known how to produce a product of high elasticity. Really strong rayon may open up sizable new industrial markets—for superior cord tires, for example.

Glossy brilliance of rayon, for many purposes advantageous, has been a limiting factor for others. A material with softer appearance has been produced by addition of titanium oxide to the "dope" from which full-dull rayon is spun. Semi-dull effects can be obtained by incorporating oil prior to spinning.

Methods for Determining Different Types of Gloss

Gloss is one of the major factors in appearance, and the problems of gloss determination differ from many other problems of measurement in that the principal problem seems to be not how to measure the quantities involved, but rather how to determine the best quantities to measure. In a paper by Richard S. Hunter recently published in pamphlet form by the National Bureau of Standards, methods for determining gloss are described and discussed.

Glossiness is evidenced by almost every object and is attributed to specular reflection. Specular reflection occurs at the surfaces of reflecting objects; and, because of diversities of minute surface structure, many kinds of glossy appearance result. Six types of gloss are identified in Mr. Hunter's paper, as follows: (1) specular gloss, identified by surface shininess; (2) sheen, identified by surface shininess at grazing angles; (3) contrast gloss, identified by contrasts between specularly reflecting areas of surfaces and other areas; (4) absence-of-bloom gloss, identified by the absence of excess reflection (haze or smear) adjacent to reflected high lights; (5) distinctiveness-of-reflected-image gloss, identified by the distinctness of images reflected in surfaces; and (6) absence-of-surface-texture gloss, identified by the lack of surface texture and points of fixation which locate the surface.

According to the author, if designs of existing gloss meters are examined they will usually be found to measure one or more of the above mentioned types of gloss. The primary requirement for each of these gloss meters is that, when applied to specimens of the type for which it is intended, it shall give results which correlate satisfactorily with gloss ratings on the same specimens assigned by visual grading.

Data which describe the directional distribution of light reflected by surfaces illuminated under specified conditions furnish the fundamental physical basis for describing gloss. However, such distribution data are cumbersome and involved and include the effects of both diffuse and specular reflection. It is because these goniophotometric (reflection distribution) data are unwieldy that, in the past, devices for measuring gloss have been developed by simple empirical means. By trial and error,

(Turn to page 742, please)

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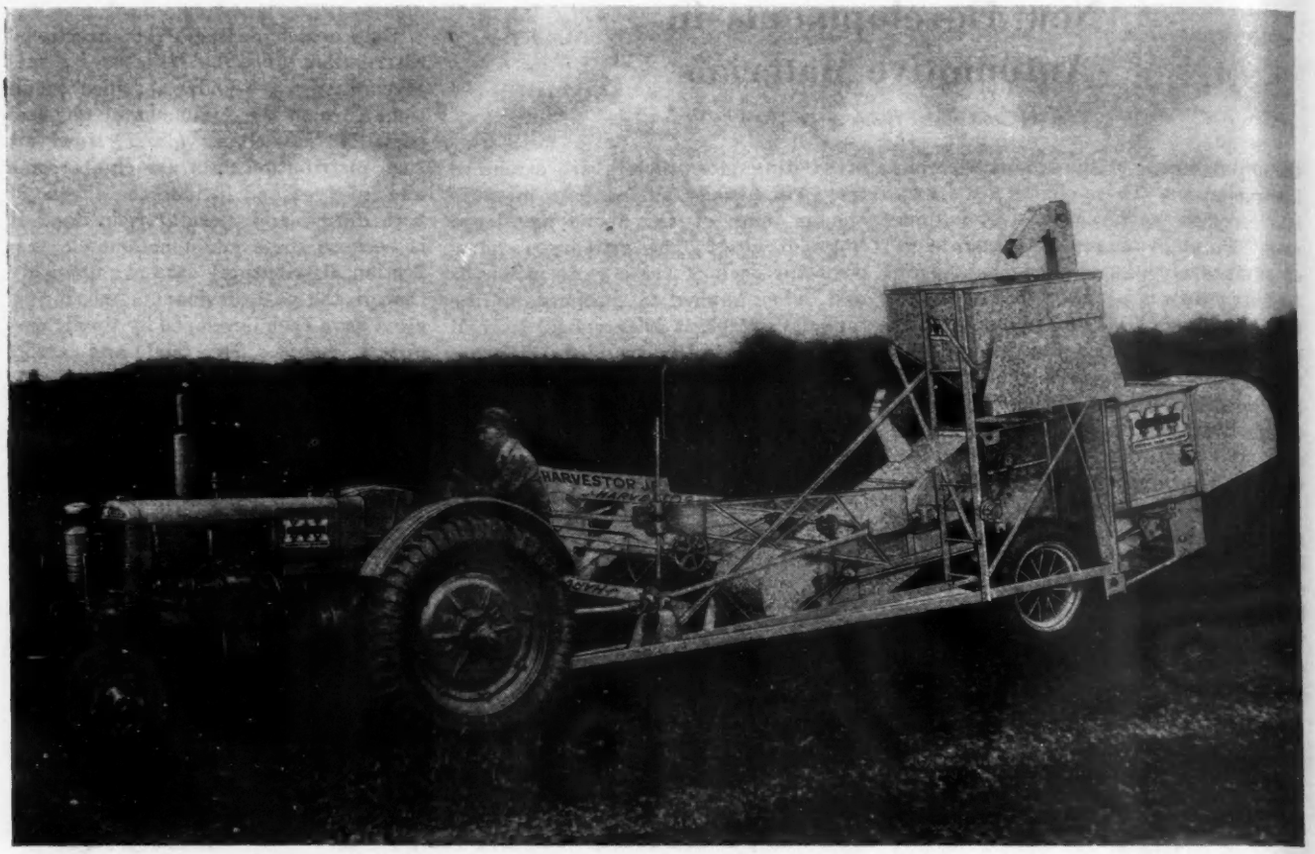

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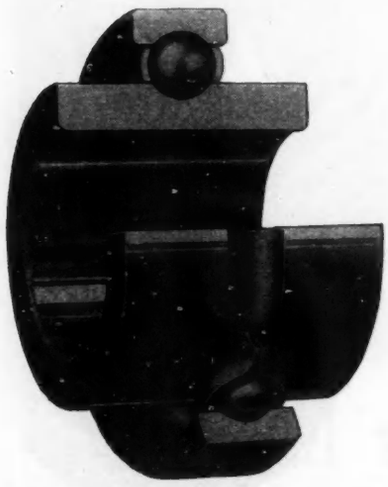

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Wide inner race bearings offer opportunities for simplification of construction and assembly. BCA engineers will gladly explain.

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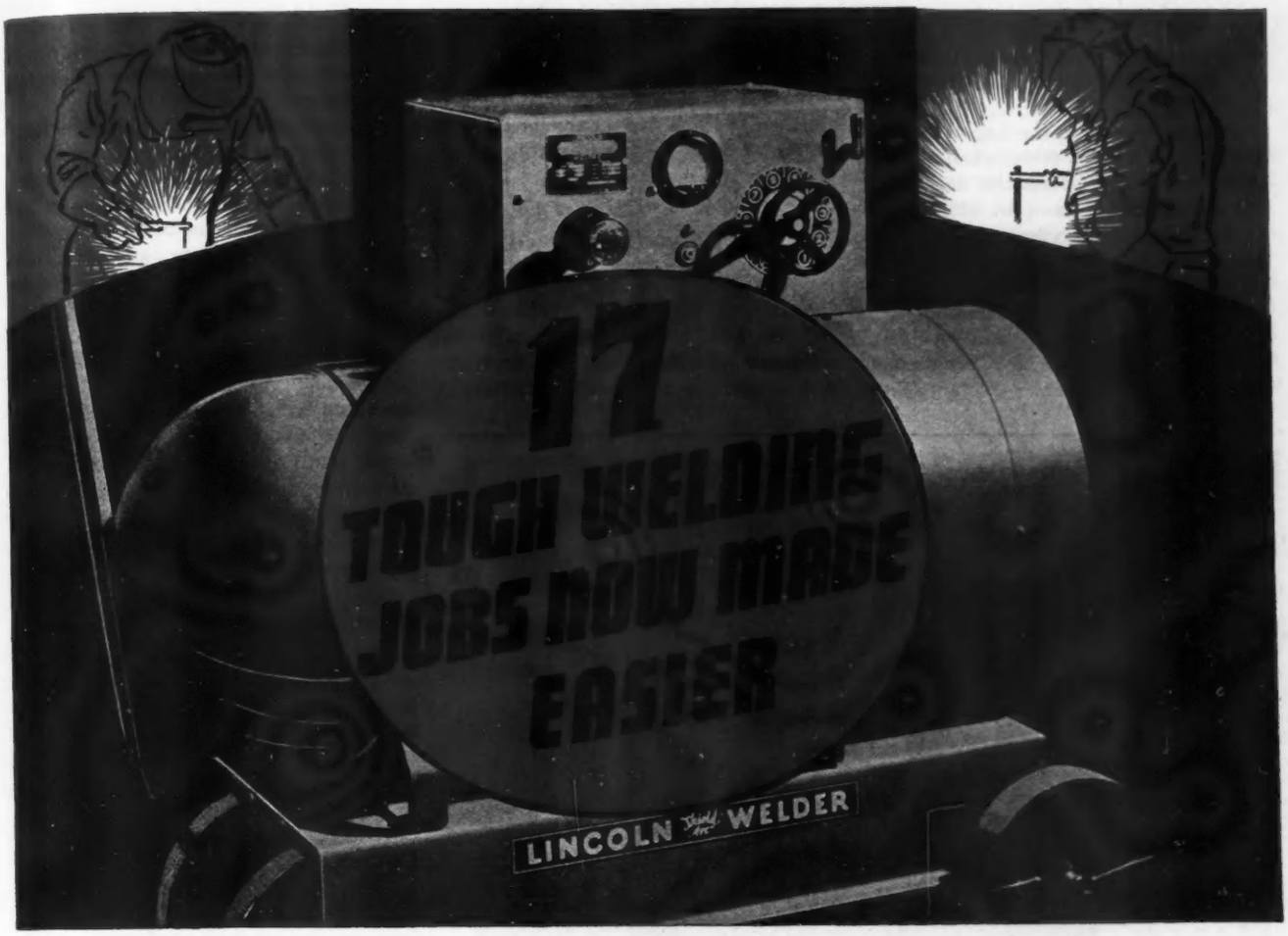

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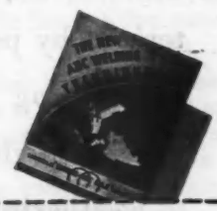

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(Continued from page 739)

methods have been found to measure the gloss of materials exhibiting particular types of gloss.

It is suggested in the paper that the designer of a gloss meter should determine from goniophotometric data taken on representative samples what differences in apparent reflectance are most characteristic of the differences in glossiness observed visually. That is, glossmeter design will have considerably less of the trial-and-error element when goniophotometric data are used to indicate the most pertinent reflectance measurements to make for various purposes.

A Pfund glossimeter for measuring the gloss of finishes is illustrated and described in an article on automobile finishes which was published in the April 17 issue of AUTOMOTIVE INDUSTRIES.

Metallic Lead Main Ingredient of New Protective Paint

"Metalead" paint, with metallic lead the main ingredient, is being developed to supplant the use of red lead. According to a report in the April issue of the *Industrial Bulletin*, the paint is made from thin lead foil broken into fine flakes. When spread upon a surface, the individual flakes of lead interleave into a film.

Adhesion and ductility of the lead-leaf paint are dependent on both lead and the vehicle; the vehicles used are Chinawood oil (tung oil); mixtures containing phenolics such as Beckacite, Durez or Bakelite; and the new synthetic resins. Linseed oil is not satisfactory.

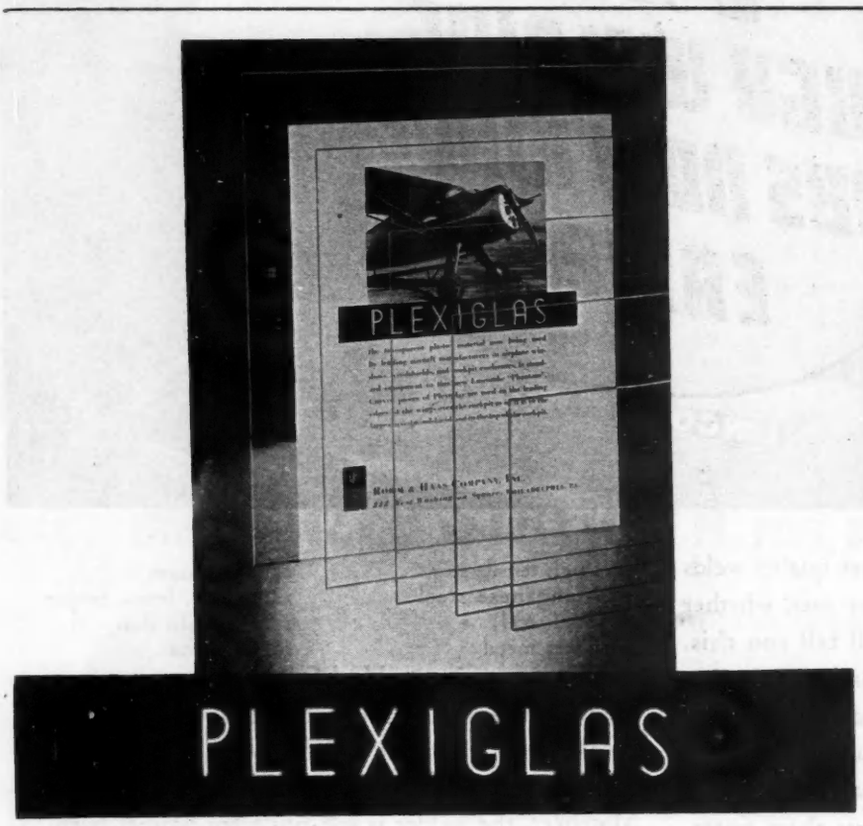
The new type coating resists temperatures up to 500 deg. F. and offers chemical resistance to fumes of common acids and to noxious industrial vapors. It may be applied directly to galvanized iron as no pretreatment of metal surface is required.

Wider Use of Cast Alloy for Crankshafts and Camshafts

Castings have by no means displaced forgings for automotive parts such as camshafts and crankshafts but increasing quantities of these important automotive components are being used in cast form. As reported in the *Nickel Cast Iron News* for May, 1937, several thousand crankshafts—produced in the past few years from nickel-molybdenum and nickel-chromium-molybdenum cast iron by a mid-western foundry—have been supplied for automobile, truck, tractor, marine, and Diesel engines. A cast alloy crankshaft is used on one production passenger car, and a leading tractor company is successfully using a nickel-molybdenum gray cast iron crankshaft in a two-cylinder engine which functions as a starter for high-powered Diesels.

Camshafts of alloy cast iron have been produced by three methods. One of these involves flame-hardening of the cam surfaces, and obtaining a martensitic structure by rapid cooling from above the critical range. In another method chills are used to provide white iron on the cam tips, the remainder of the casting being gray to facilitate machining. Still another practice is to select an alloyed iron that will cast gray and respond to liquid quenching for hardening the tips. The last mentioned method is used in designs where avoidance of warpage is not a primary consideration. Certain types of alloy irons which are capable of air-hardening may also be employed.

The essential mechanical property in camshafts is a high degree of wear resistance. For crankshafts torsional and fatigue strength, rigidity and damping capacity are all-important. While fatigue properties in cast iron



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have not been sufficiently investigated to permit establishing a definite ratio of endurance limit to tensile strength, it has been tentatively placed within the range from 40 to 55 per cent of the ultimate. If a forged crankshaft of SAE 1045 carbon steel having a tensile strength of 140,000 lb. per sq. in. is compared with a high-test cast iron of 70,000 lb. per sq. in. tensile strength, and the fatigue ratio is assumed in each case to be 50 per cent, the forged steel has twice the fatigue limit of the cast iron. However, sensibility to notch effects is much lower in cast iron than in steel and seems to place alloy cast iron in a position to compete with the forged material.

Large Quantities of Thermostat Metals Used on Modern Engines

The use of large quantities of thermostat metals in modern automotive engines is pointed out in a bulletin recently issued by the International Nickel Co. These materials, in the form of coil springs, control carbureter opening, heater by-passes, and radiator cooling water by-passes.

Thermostat metals usually consist of high-expansion material bonded to a low-expansion material; under the influence of heat a definite deflection results. Invar type steel with 36 per cent nickel is widely used as the low-expanding material. The other is usually an austenitic high nickel-chromium or nickel-manganese steel. Brass, bronze and Monel are also used. As many as 8 to 12 thermostats are now incorporated into some automobile power plants.

Thermostats placed in radiator cooling water by-passes prevent circulation of water through the engine block until the temperature of the block is raised to approximately 160 deg. F—or some other predetermined temperature. It is frequently recommended that the radiator thermostat be changed for winter and summer driving to obtain desirable engine operating temperature.

Silicon - Manganese - Nickel Alloy For Sparkplugs

New silicon-manganese-nickel alloy for use in spark plugs has been developed by Wilbur B. Driver Co., Newark, N. J. The alloy is said to be especially resistant to attack by oxygen and sulfur, and to have the property of high resistance to mechanical disintegration at operating temperatures. Other claims for the product, trade-named Sparkaloy, include surface uniformity, thorough annealing, and excellent welding properties.

Reflections of Automotive Progress

(Continued from page 737)

Melville F. Peters, George F. Blackburn and Paul T. Hannen presented a paper on the electrical characteristics of the spark discharge of automotive ignition systems, the results of an investigation sponsored by the Bureau of Aeronautics of the Navy Department. Three methods of measuring the discharge current by means of the cathode-ray oscillograph were described, viz., (1) by measuring the voltage drop across a resistance; (2) by measuring the voltage drop across an inductance, and (3) by deflecting the cathode beam magnetically by means of coils introduced into the circuit. The general principles of these methods are well known, but the electrical magnitudes involved in automotive ignition circuits impose limitations on their application,

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and the primary object of the undertaking was to develop a technique for determining the character of automotive spark discharges without materially changing the characteristics of the ignition circuit. A technique for measuring the voltage across a spark-plug gap, using a low-capacitance voltage divider, was developed by the authors previously and was described by them in the B. S. *Journal of Research* 9, 81 (1932).

The Dufour or cold-cathode type of oscillograph is well suited to this work, because of the high-speed transients involved. Its voltage sensitivity is only about 0.0016 in. deflection of the cathode beam per volt, and several hundred volts are required to give a convenient deflection. If the crest current is 50 amperes, a resistance of 5 ohms would give a deflection of 0.4 in. It has been found that the effective resistance of the discharge circuit is of the same order of magnitude, and the addition of such a resistance therefore would seriously alter the decrement of the circuit.

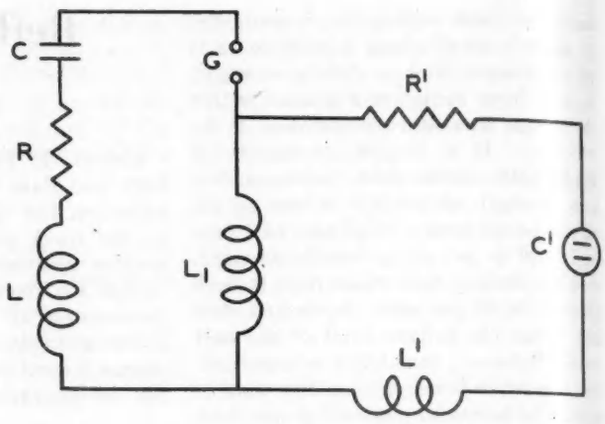

Diagram of circuit used in measuring voltage across inductance.

A much smaller resistance could be used if the voltage drop across it were amplified, but the difficulty there is to find a resistor with negligible inductance. At high frequencies, inductance in the resistor results in an inductive-voltage component in the deflection which may be greater than that due to the resistance. This was confirmed by experiments with so-called non-inductive resistors, which suggested the advisability of measuring peak currents by measuring the voltage drop across a known inductance.

For use with the last-mentioned method, the following approximate relation between current and voltage is deduced—

$$I = \frac{V}{\omega L_1}$$

where I is the crest current; V, the crest voltage; $\omega = \sqrt{1/C - R^2/4L^2}$, C being the capacitance; R, the resistance, and L, the inductance of the circuit; L_1 is the inductance across which the voltage is measured.

To apply this method of current measurement, a single-layer coil is constructed whose inductance can be measured or readily computed. The magnitude of the inductance must be such that the characteristics of the discharge are not affected to any considerable extent by its inclusion in the circuit, and that a convenient deflection on the oscillograph is produced by the discharge. The high-frequency resistance of the coil can be made negligibly small in comparison with its inductance, and the self-capacitance can also be made negligibly small. The quantities

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Derma-San gives you simple, positive protection. One pint poured into 35 gallons of lubricant kills oil dermatitis germs *before* they attack your workers. For Derma-San is a powerful disinfectant. It is non-toxic, non-corrosive . . . does not irritate.

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V and ω are obtained from oscillograms.

Fig. 1 shows diagrammatically the arrangement used for measuring the potential difference across L_1. The capacitance C' represents that of the oscillograph plates and of the voltage divider, if one is used. The resistance and inductance of the connecting wires are represented by R' and L' respectively. In order to reduce the effect of the measuring circuit on the discharge circuit C' should be small compared to C.

Assuming that the influence of the measuring circuit on the discharge circuit is negligible, it is next necessary to determine the effect of the electrical constants of the connecting leads on the pattern obtained in the oscillograph. In order to do this, a damped high-frequency voltage whose maximum value is known is applied to the terminals of the inductance L_1, and the oscillograph deflection compared with the deflection due to the same voltage at low frequency. This serves to determine what correction, if any, must be applied to the current values obtained from the deflections measured on an oscillogram to obtain the true current in the discharge circuit. The maximum value, frequency and damping of the current used for this calibration are made as nearly as practicable like those of the current in the ignition circuit to be studied, and it is then assumed that the same correction factor is valid for both circuits.

The paper also dealt with the third method, by measurement of magnetic deflection, in detail, and described the apparatus required and the experimental procedure.

Fundamentals of Vehicle Performance

THE two principal characteristics of a commercial motor vehicle are its capacity and its performance ability, said Merrill C. Horine of Mack Manufacturing Corp., in a paper on Fundamentals of Vehicle Performance. Mr. Horine discussed particularly such equipment as over-geared transmissions, two-speed rear axles, third axles and semi-trailers, and he pointed out that it is impossible to increase the gross weight moved by a vehicle without at the same time reducing its performance ability, and in the exact inverse ratio.

In spite of the absurdities and fallacies which pervade the specification and sale of some of the equipment intended to increase truck performance (said Mr. Horine) nevertheless, with the possible exception of over-geared transmissions where properly-designed direct-drive transmissions are available, all of these have a legitimate sphere of usefulness. Semi-trailers offer advantages with respect to operation under various state laws, in their adaptability to shuttle service, and ready interchangeability of body types, which assure their continued usefulness.

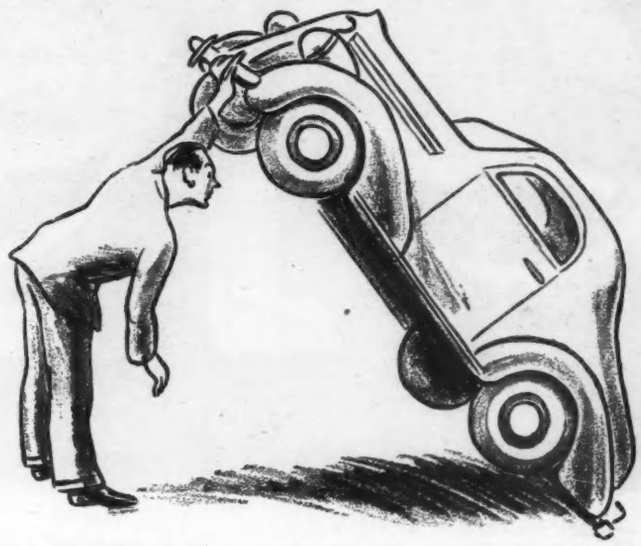
In the same way, six-wheel attachments are very useful adjuncts where heavy loads are to be carried in states having severe axle-weight limitations. The six-wheel truck also offers advantages in that it permits heavy loads to be equitably distributed between tires without such front-wheel loading as will prejudice ease of steering. Six-wheel vehicles are also known to be extremely safe against skidding, and when all four rear wheels are driven, to possess superior traction qualities.

Auxiliary transmissions have a definite place in the transport picture, both as makeshifts pending the development of transmissions truly adequate for modern demands, and as means of

(Turn to page 747, please)

Have you a use for this

EXTRA STRONG DUREZ 1590?



Five times the impact-strength of ordinary plastic material—that's what you get in the new Durez 1590!

There must be places in your car, truck, bus or plane where this tougher molding material can be used to advantage. Places where ordinary materials lack strength. Mechanical parts where its light weight and wear resistance are valuable. Structural parts where you need its insulating value, or chemical resistance.

Durez 1590 has all the properties of regular phenolic plastics, except for a slightly rippled, wavy surface, which can be minimized by ribbing or engraving on decorative parts. It's furnished in black and natural.

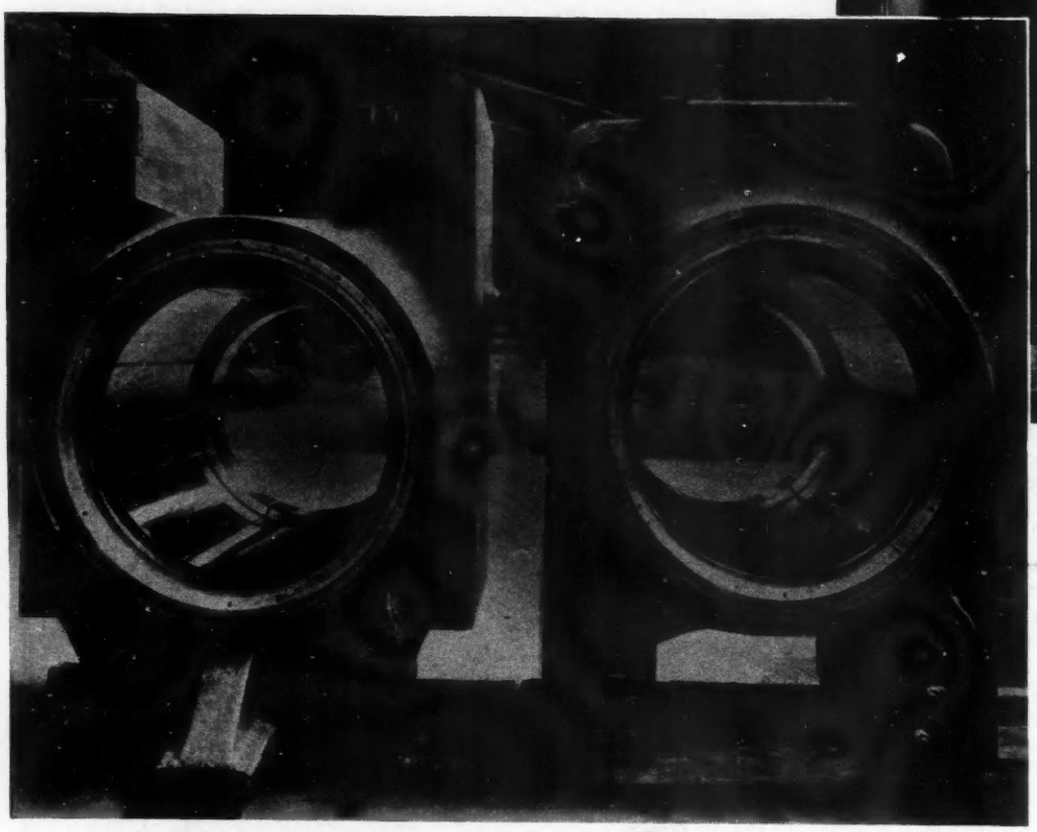
Check over chassis and body for parts that can be made better or less expensive with this new molding compound. We'll gladly send you or your molder more complete information, samples, etc. Write General Plastics, Inc., 25 Walck Road, North Tonawanda, N. Y.

General Plastics'

DUREZ *Choice of the Automotive Industry*

5,247,000 lb. load

CARRIED BY U·S·S CARILLOY ALLOY STEEL



Photos courtesy of Morgan Construction Company, Worcester Mass.

(Above) *Its perfect mirror finish is especially remarkable in view of the fact that it is only ground — not polished. This accurate finish truly reflects the quality of the steel.*

(At Left) *Here it is — the world's largest capacity roll-neck bearing — designed to carry a radial load of 5,247,000 lb. — and made of USS Carilloy Alloy Steel as specified. In view of the investment involved it would obviously be poor economy to select any but the finest available alloy steel*

IN the photograph above you see another record-breaker . . . the largest capacity rollneck bearing in the world.

This bearing is made of a grade of USS Carilloy Alloy Steel—one of the family of high quality alloy steels made and sold by Carnegie-Illinois. This steel was specified by the design engineers who are responsible for its performance.

It is a flood-lubricated sleeve-type bearing of the 56″-90 series—part of a new 3-stand tandem rolling mill—designed to carry a radial bearing load of 5,247,000 lb.

To make a bearing of this size and capacity economically feasible, to insure long life, minimum wear, and smooth accurate surfaces . . . it is obvious that the maker would not fail to select the finest, the most dependable alloy steel available.

In recent advertisements, you have read of the precision quality of USS Carilloy Alloy Steels and the delicate control under which they are made . . . how, to insure maximum quality and utmost uniformity, we have concentrated on alloy steel production in special alloy plants.

This application is interesting evidence from an unbiased source . . . evidence that USS Carilloy Alloy Steels are, in fact, the finest alloys it is now possible to make.

U·S·S CARILLOY ALLOY STEELS

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh *Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

(Continued from page 745)

meeting extraordinary requirements as to ratio range.

A new proposal was made in the paper with regard to the figure by which "the gear" of the truck is expressed. Equal rear-axle ratios will give equal tractive effort and speed only when engine r.p.m. and loaded radius of driving tires are equal. It was therefore suggested that, as a true measure of speed reduction, the expression "feet per revolution" be used, meaning the number of feet of forward travel of the vehicle produced by one revolution of the engine, for which the formula is:

$$\frac{2\pi \times \text{loaded tire radius in in.}}{12 \times \text{total reduction per revolution.}} = \text{Feet}$$

or simplified:

$$\frac{0.5236 \text{ loaded tire radius in in.}}{\text{total reduction per revolution.}} = \text{Feet}$$

In concluding his paper Mr. Horine said he doubted whether the many variations of overgeared transmissions and auxiliaries would have been developed if manufacturers had had a free hand in effecting the best solution of each user's problem. Adequate ratio ranges within the compass of standard transmissions, suitable for well over 90 per cent of all applications, can be economically provided by truck manufacturers, which will prove far more serviceable to operators and more convenient to drivers. The makeshift combinations which are in use today, to a very considerable extent, are produced because the industry has not generally caught up to operators' demands. Further advancement will certainly be delayed as a result of the pressure of competition and by the insistence of operators upon specifying not only the results to be obtained but the means by which they are to be produced.

Radio Problems in Air Service

MODERN airplane radio receivers are of very high sensitivity and therefore are influenced by extremely small electrical disturbances, said Harold E. Gray of American Airlines, Inc.; consequently there is more need today for effective shielding than there was when radio was first introduced.

Present-day shielded ignition harnesses may be divided into two classes, viz., those employing individually-shielded conductors, and those with a common shield or manifold from which the individual wires are distributed by means of flexible leads designed to have shielding properties. The junctions of the leads with the spark plugs differ with the type of spark plug or spark-plug shield used. Unfortunately, the shielded conductors act as condensers and reduce the amount of electrical energy available at the spark plugs. The reduction depends on the capacity of the shielded leads, and efforts should therefore be made to reduce this capacity. Some experimental data were given by the author showing that as the capacity of the ignition harness is increased the current across the spark gap is reduced. For instance, with a manifold-type of shielded ignition harness and a "combustion-chamber" pressure of 100 lb. per sq. in., the ignition current decreased uniformly from 92.5 milliamperes with a capacity of 50 mmf., to 65 milliamperes with a capacity of 150 mmf. in the line. It was also found that with such shielded ignition harness the different plugs received different amounts of energy, the difference amounting to as much as 28 per cent.

It is generally observed that when

(Turn to page 750, please)

CONTINENTAL-DIAMOND PLASTICS

for faster cleaning pickling and plating

HAVEG

MOULDED PLASTIC

- Acid Resistant
- Unaffected by Rapid Temperature Changes
- Tough
- Durable
- Non-Metallic

HAVEG is a molded plastic material combining phenolic resin and asbestos to provide handling, storing and processing equipment that is completely acid resistant. Haveg Tanks can be furnished in single one piece units without seams and joints as large as 9′ high by 9′ in diameter. Haveg Piping and Fittings are furnished in standard sizes to meet practically every liquid, vapor and fume handling problem involving corrosion. Haveg engineers will be glad to consult with you about your chemical corrosion problem, treating in strict confidence any information you may furnish them which will enable us to make suggestions regarding the proper type of Haveg equipment to be used.

HAVEG CORPORATION

Newark, Delaware

A SUBSIDIARY OF CONTINENTAL-DIAMOND FIBRE COMPANY

PRATT & WHITNEY

Above: Electrolimit Gages check and grade wrist pins at 700 per hour.

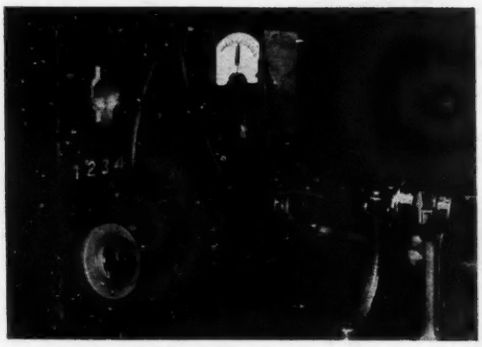
Electrolimit Gage in the Automotive Industry

THIS most modern instrument for governing production accuracy has won its automotive spurs. In its various forms it has reduced costly inspection to a simple routine. But most of all, because it can sort parts with uncanny speed into accurately matched groups, it has reduced assembly time and troubles tremendously.

Pratt & Whitney Electrolimit gages will smooth out your gaging difficulties. They pay for themselves in short order by reducing costs—and then go right on producing dividends.

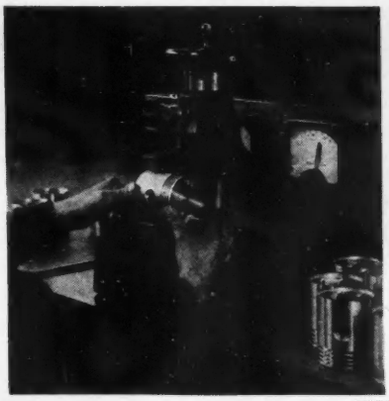
Let us give you the complete facts and figures.

PRATT & WHITNEY DIV.
NILES-BEMENT-POND COMPANY
Hartford, Conn.

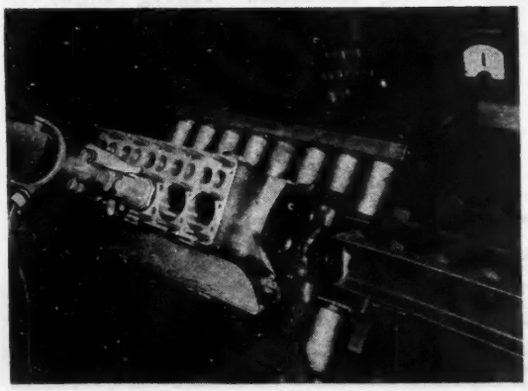


Electrolimit Internal Comparator gaging and grading for selective assembly the crankshaft bore of an automotive connecting rod.

Below: P&W Electrolimit Cylinder Bore Gages measure and grade for selective assembly the bores in automotive cylinder blocks.

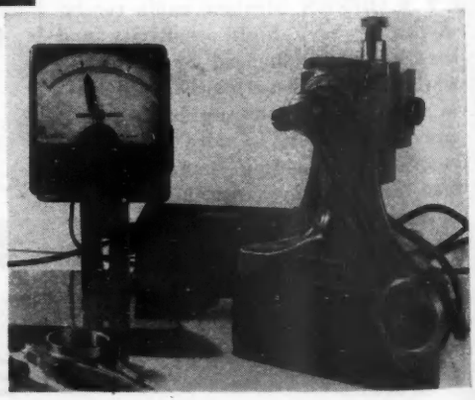


Above: P&W Electrolimit Internal Comparator checking and grading the wrist pin hole in automotive pistons for selective assembly.



Above: Checking the outside diameter of automotive pistons and grading them for selective assembly, using the P&W Electrolimit Gage.

Right: Electrolimit Internal Gage checking and grading a connecting rod wrist pin hole.



Save money on ALL THREE with Jalcase

J&L Jalcase Steel saves you money in every step in the manufacture of parts that require forging, machining and heat-treatment . . . and gives you a better finished product.

Jalcase has excellent forging qualities. It flows freely to give you fully formed parts . . . with less wear on dies.

Jalcase offers machinability well above that of any steel of comparable carbon content . . . gives you increased machining speed, less tool wear, and improved finish at lower cost.

Jalcase responds readily to heat treatment. Minimum time is required to produce the desired depth of case, and its heat treating characteristics result in a hard, wear-resisting case with tough, ductile core.

Jalcase Steel is available in three carbon grades, .10/.20, .25/.35, and .30/.40 . . . hot rolled or cold finished.

With high carbon Jalcase, you get the advantages of costly alloy steels at the cost of ordinary carbon grades.

Get increased production . . . fewer rejects . . . higher quality parts that make satisfied customers . . . and increase your profits. Use Jones & Laughlin Jalcase Steel.

This special bulletin describes Jalcase . . . the unique steel developed by Jones & Laughlin. To be sure of receiving your copy, write for it today . . . on your business letterhead.

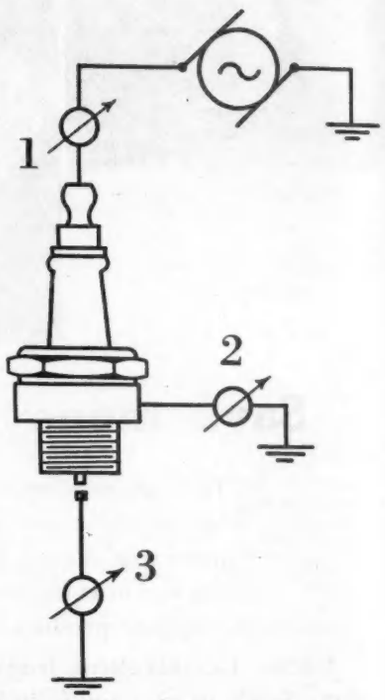
JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH, PENNSYLVANIA
MAKERS OF HIGH QUALITY IRON AND STEEL PRODUCTS SINCE 1850

(Continued from page 747)

one of the two magnetos of an engine is shut off and the engine is operated on a single magneto, there is a considerable drop in engine speed, and the engine generally also shows greater "roughness." This is undoubtedly due to the inequalities in the sparks from different plugs. There is no doubt that if all of the cylinders received the maximum electrical energy received by any of them, the fuel economy could be improved.

The author also gave an account of some tests of current leakage across the spark-plug insulator. The spark plug was insulated from the body of the engine and thermo-couple galvanometers were connected as shown in the sketch. With current flowing across the spark gap, it was found that there was a considerable current flowing from the spark-plug shell to ground, as indicated by meter No. 2. With some types of plug, for a current of 100 milliamperes across the gap, meter No. 2 showed 30 to 35 milliamperes, while with another type of plug, for a current of 125 milliamperes across the gap, the flow to ground was only 20 milliamperes. This leakage current is probably the result of the condenser action of the plug. With porcelain plugs the leakage current was generally smaller than with mica plugs for the same spark current. In view of the fact that the plugs which passed the greater current usually had the least leakage, the conclusion seems warranted that reduction of the leakage might make the spark more effective.

Considerable difficulties are encountered in providing high-output engines with effective, durable ignition harness. Wires adjacent to the spark plug are apt to burn and their insulations to rupture, owing to excessive temperatures. Some improvement was made in this respect by a change in the method of distributing the ignition wires from the ignition manifold to the cylinders with a view to providing better cooling.



Basic circuit used for measurement of "leaking" current in spare spark plug cores

Moisture, particularly at the connectors, has been another source of trouble. It was found that this moisture either got into the system through improperly sealed connections or else was due to condensation. With certain types of ignition cable the layer of cotton braid over the rubber insulation was found to act as a wick. When this became satu-

Tego-Bonded Packard Station Wagon body built by Baker Rau Lang Corp.—plywood by Davis Plywood Corp.

TEGO-BONDING

MEANS EXPOSURE-PROOF PLYWOOD

PLYWOOD that is really proof to water, weather and mold has become an established commercial product in the past two years.

Tego-bonding—gluing with dry resin film adhesive—has made the availability of such a material a fact.

Tego-bonded plywood offers not merely improved resistance to moisture and exposure breakdown. It offers permanent assurance against delamination due to glue deterioration, whether from water, climate changes or mold growth.

Tego Resin Film is manufactured by *The Resinous Products and Chemical Company, Inc., Philadelphia, Pa.*

RESINOUS PRODUCTS

rated with moisture, a leakage path was afforded, and after traveling along the saturated braid underneath the outer covering of insulation, the spark would jump through the thin layer of outer braid and lacquer to "ground" some ¾ in. behind the terminal. This trouble was overcome by treating the ends of all such cables with an insulating varnish.

Harness installed on the front of the engine is more accessible than that at the rear, but it is subjected to more wear and tear owing to the constant work around the engine. Magneto shields also have been a great source of trouble, as in the past the provisions made against the entrance of oil and water have been inadequate. The contact surfaces have been insufficient and the general design has been such as to make installation or removal from the magneto while on the engine extremely difficult. The low tension wires of the ignition system also must be shielded in order to prevent radio interference. It is undesirable to run the wires from the magneto to the switch through the same conduit with battery wires, as owing to inductive effects the ignition impulses may be carried to all parts of the ship.

Aside from shielding the ignition system, a great deal of attention is devoted to general bonding and shielding. Practically all electrical circuits are carried in conduit. Electrical panels are enclosed in metal boxes. Control surfaces are bonded across the hinge points. Control cables are bonded at points of attachment and around turnbuckles. In general, an attempt is made to tie all metal parts together electrically. If any appreciable length exists between bonds, noise may result if the part comes in contact with other metal parts, as there may be a difference in voltage along its length due to charges accumulating, and the point of contact during vibration provides a discharge point, resulting in another form of interference. The treating or painting of metal parts before assembly frequently defeats the attempt to hold them at a common electrical level. Care should be used in the application of paint or dope to parts and locations where bonding is intended. Clamps holding conduits in place must be made secure, particularly those in obscure locations.

New Air-Drying Lacquers Withstand High Temperatures

A new line of clear and pigmented air-drying lacquers, specially designed for finishing electrical equipment and other products normally subjected to elevated temperatures, has been developed by Maas & Waldstein Co., Newark, N. J.

These finishes, which are known as Durheat lacquers, are claimed to retain their flexibility, color, and adhesion indefinitely at temperatures up to 300 deg. F.

Durheat lacquers are supplied in clear, black, white, and all colors, and can be applied by either dipping or spraying. They can be applied directly to any metal except polished chromium. When used on the latter metal, the surfaces to be finished are first covered with a baked coat of Chroprime.

Long Life Micrometer

Wear Points on Instruments Are Tipped with Cemented Carbides

Carboloy Co., Inc., Detroit, Mich., has inaugurated a service whereby micrometer users may have their instruments tipped with cemented carbides on the wear points at the ends of the anvil and spindle. It is reported that tipped micrometers will hold to a closer degree of accuracy during a period of use averaging 50 times longer life than untipped instruments.

CONTINENTAL-DIAMOND PRODUCTS

Other CONTINENTAL-DIAMOND products

developed to help you build more efficient and economical automobiles

DIAMOND Vulcanized Fibre

a tough electrical and mechanical insulating material made in sheets, rods and tubes that are readily fabricated or formed. *Diamond Insulation* is an exceedingly tough thin grade of DIAMOND Vulcanized Fibre. It will stand extreme bending without cracking and in addition to toughness possesses a hard surface that resists abrasive action. *Diamond Insulation* is made in sheets, continuous rolls and in ribbon rolls for automatic machines.

MICABOND

Mica in its most usable form. Large splittings of Mica bonded with a binder that is highly resistant to moisture and heat and consequently brings to practical use the desirable properties of raw Mica by making it adaptable to fabrication and forming. There are many forms and grades of MICABOND, possessing varying characteristics—properties that have been brought out to meet specific insulating needs.

VULCOID

Vulcoid is a laminated fibrous insulating material, combining many desirable features. While it does not have as good moisture resisting properties as phenol Fibre it is for all practical purposes non-hygroscopic. It is tough. It can be formed by heating and will retain its shape. It is made in sheets, rods and tubes which are adaptable to many insulating problems where a combination of great mechanical strength, high electrical insulating properties, and moisture resistance are important. It is readily machined, punched or stamped.

CONTINENTAL-DIAMOND FIBRE COMPANY
Newark, Delaware
Represented in Canada by DIAMOND STATE FIBRE COMPANY of CANADA, LTD.
Toronto

Women ARE ESPECIALLY INTERESTED IN CONTINUED FINE APPEARANCE *assured by* PARKER PROCESSING

Beautiful appearance is a woman's first concern in buying a car. And, if she can be assured that under the paint is a protective quality that will keep it fresh and new looking, a strong sales point has been made.

In addition to horsepower, miles per gallon and trouble-free operation, continued fine appearance is a potent sales argument—to both men and women.

Bonderizing under the finish on sheet metal is important to both the customer and the dealer. It eliminates many complaints about peeling paint and rusty spots. It saves the customer refinishing expense and keeps the car looking better—all the way through to the used car lot. If the car you sell is Bonderized, make sure that the customer knows about it.

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